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FIG. 1
PRIOR ART

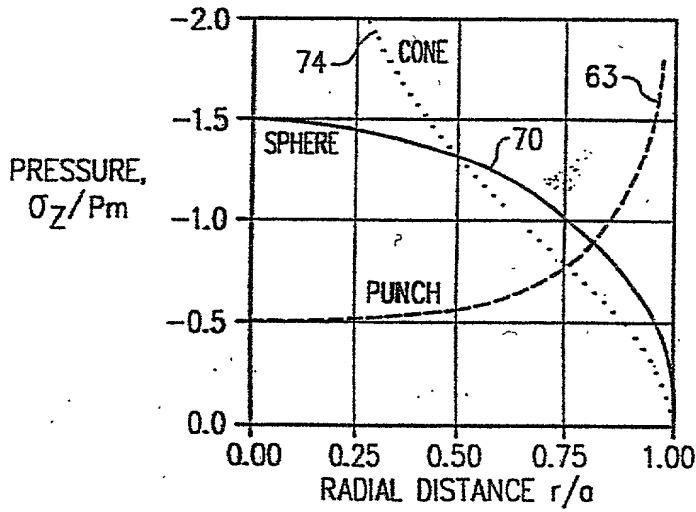


FIG. 2
PRIOR ART



FIG. 3
PRIOR ART

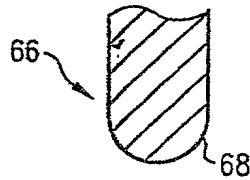


FIG. 4
PRIOR ART

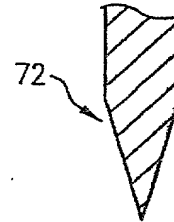
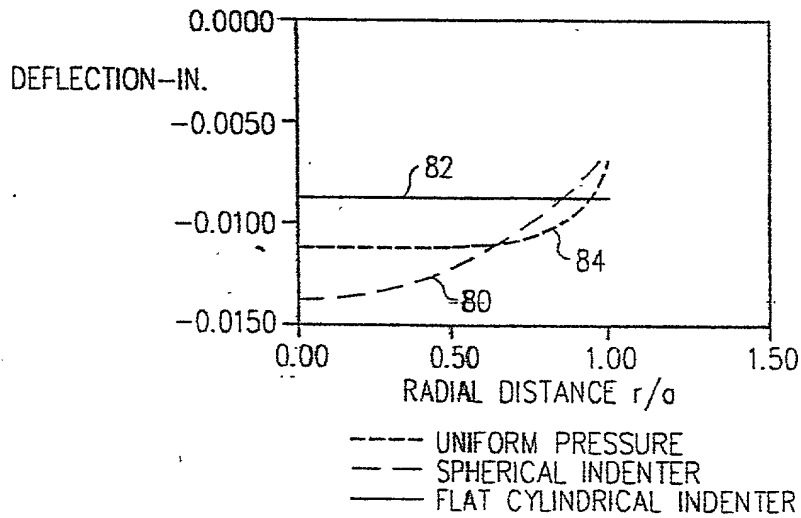


FIG. 5



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FIG. 6

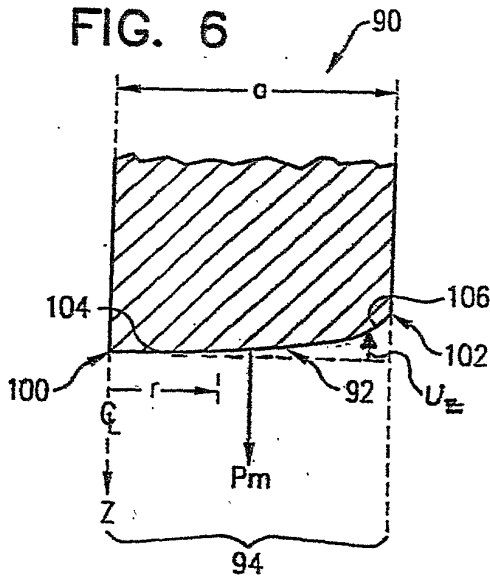


FIG. 7

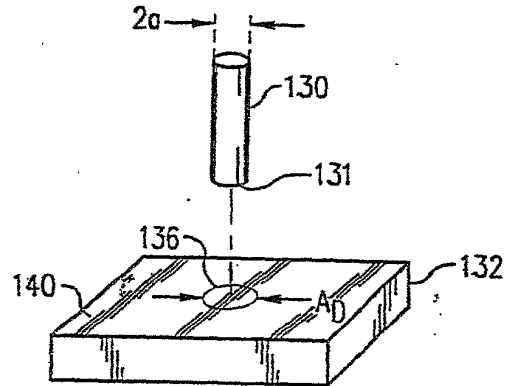


FIG. 8

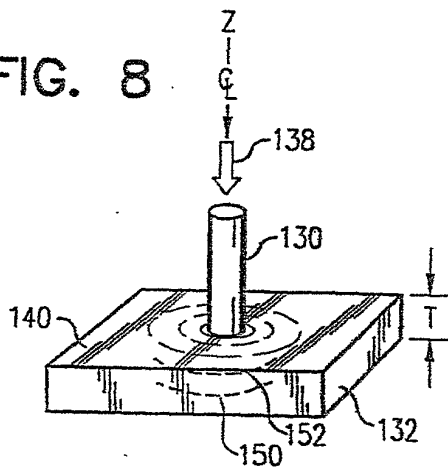


FIG. 9

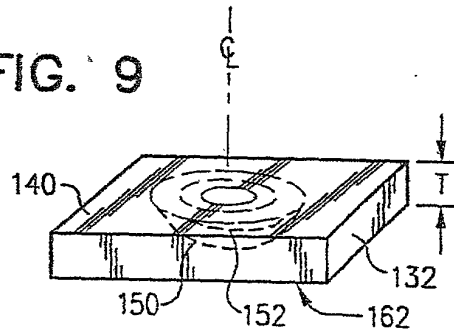
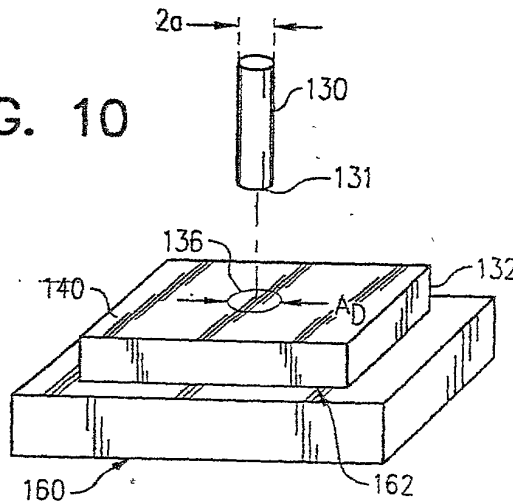


FIG. 10



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FIG. 11

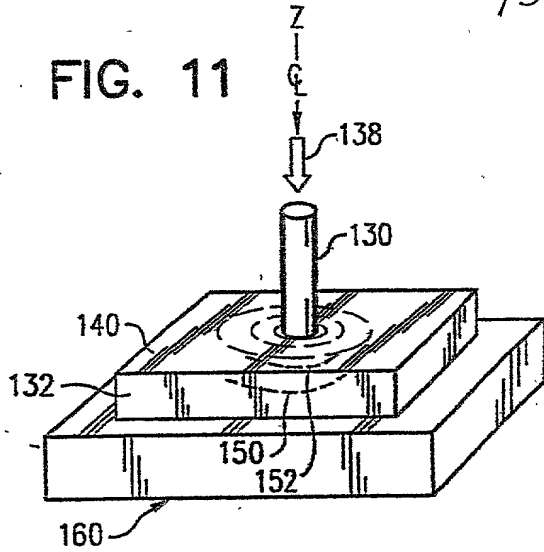


FIG. 12

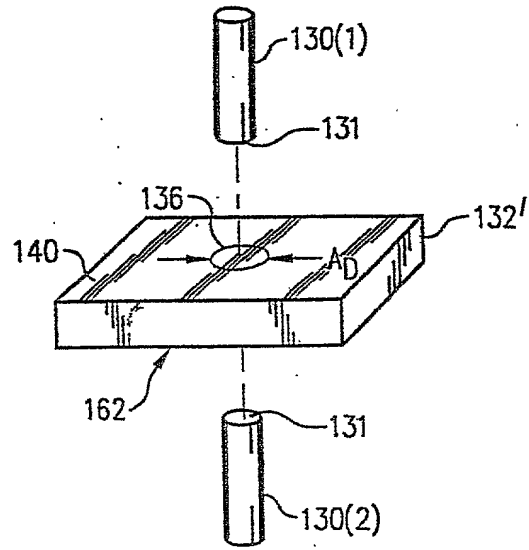


FIG. 13

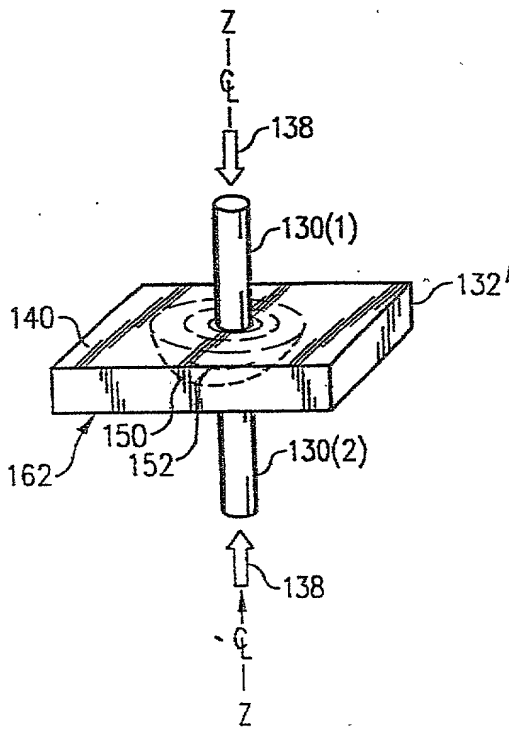
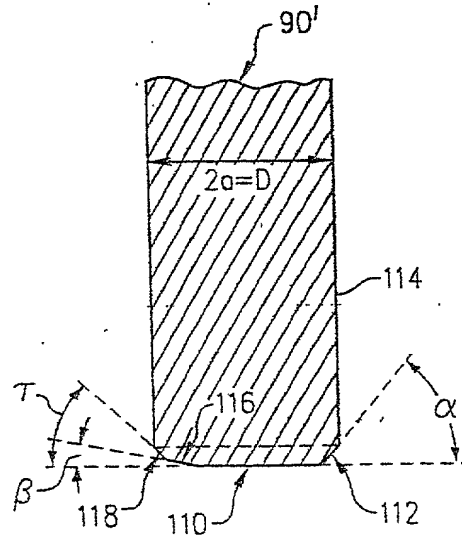


FIG. 14



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FIG. 15

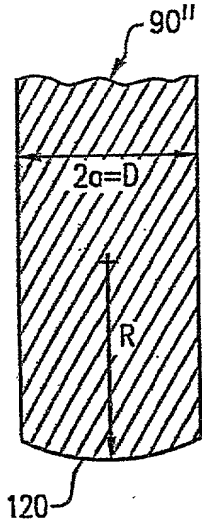


FIG. 16

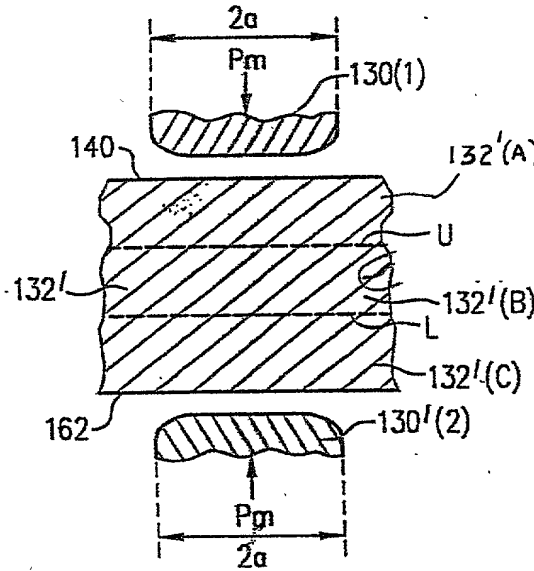


FIG. 17

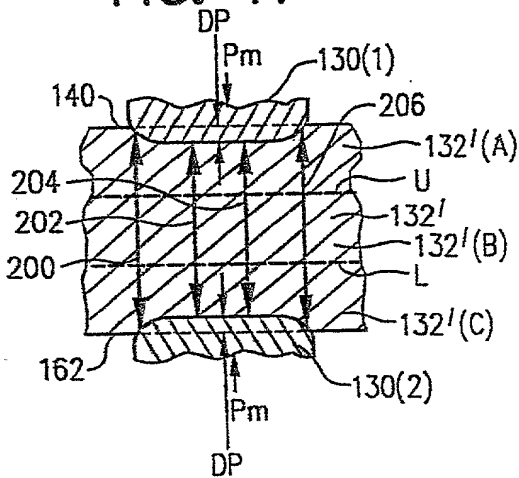


FIG. 18

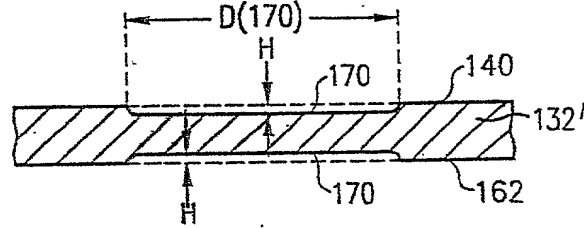


FIG. 19

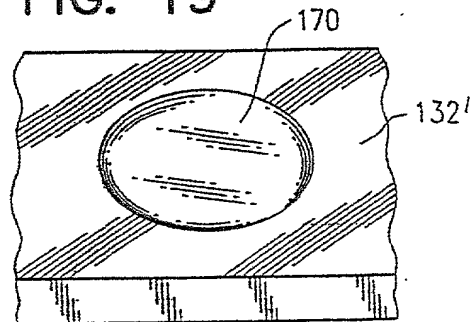
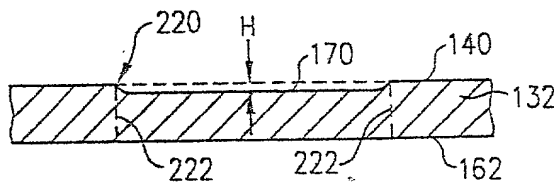


FIG. 20



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FIG. 21

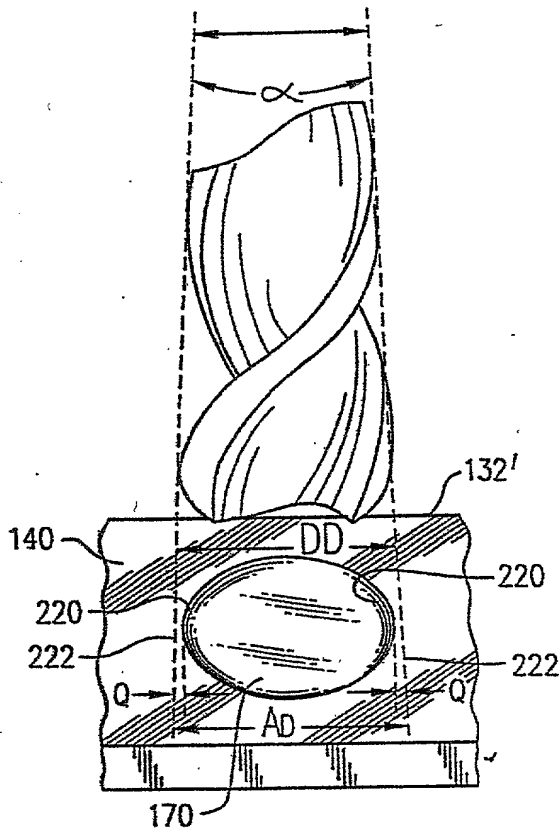


FIG. 22

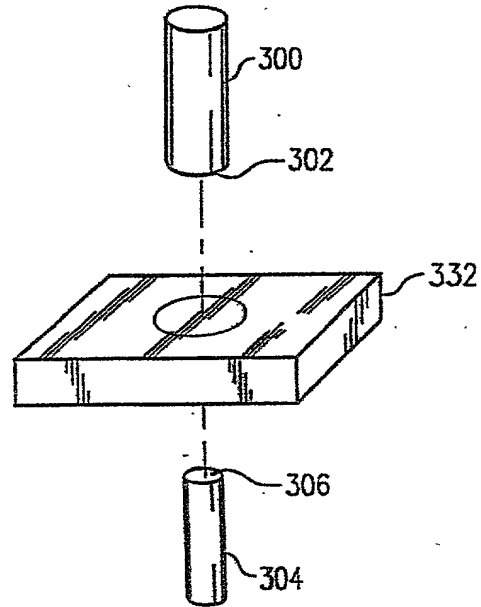


FIG. 24

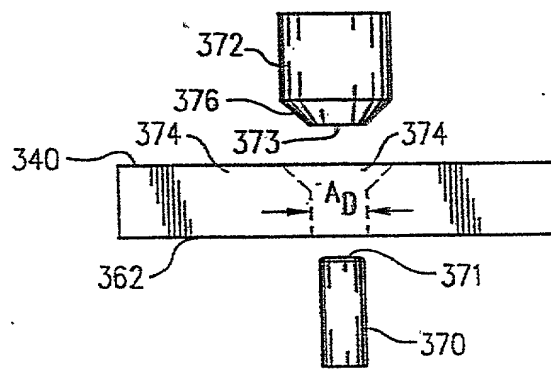


FIG. 23

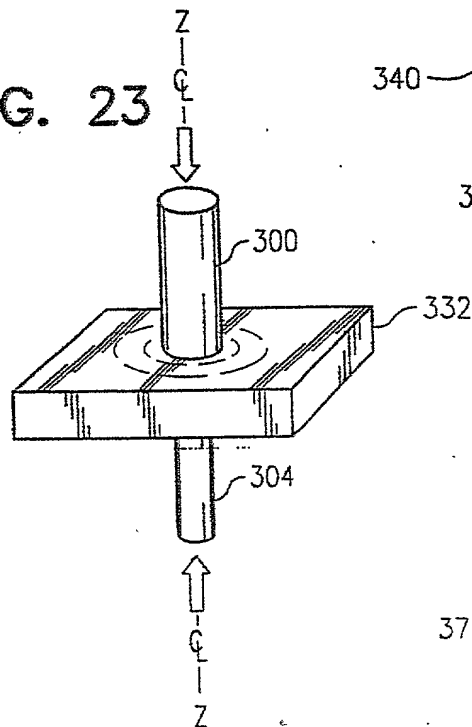
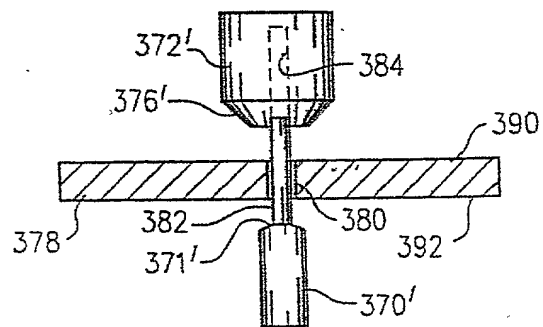


FIG. 25



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FIG. 26

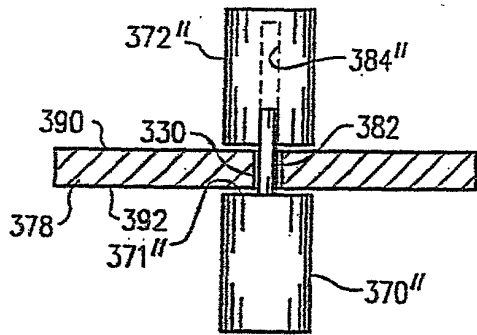


FIG. 27

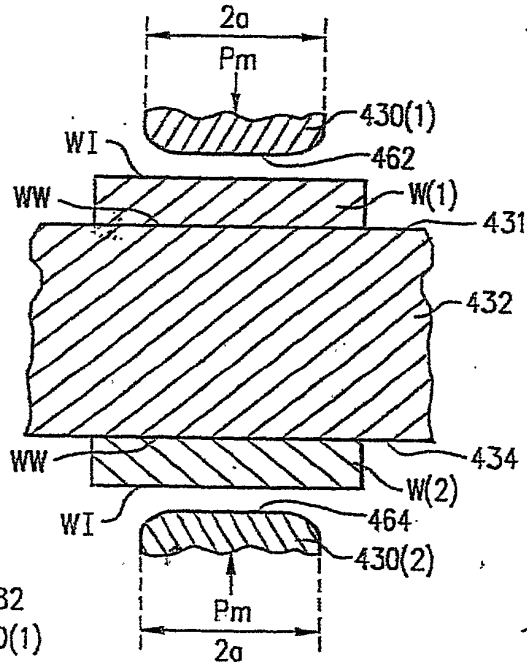


FIG. 28

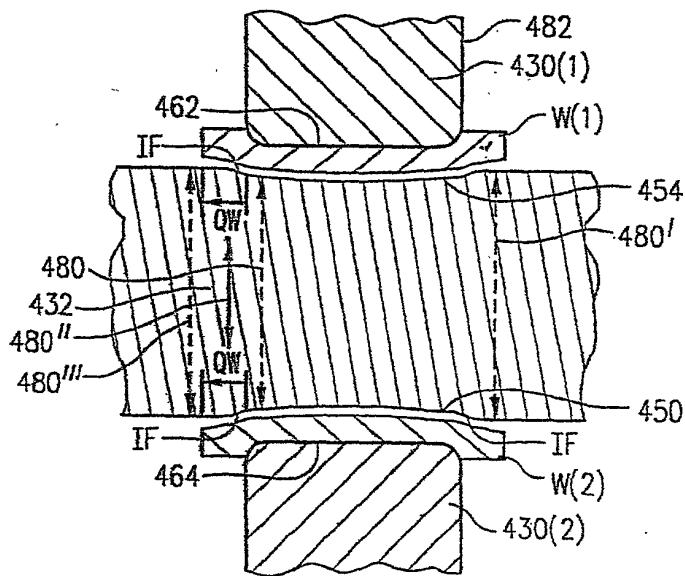


FIG. 31

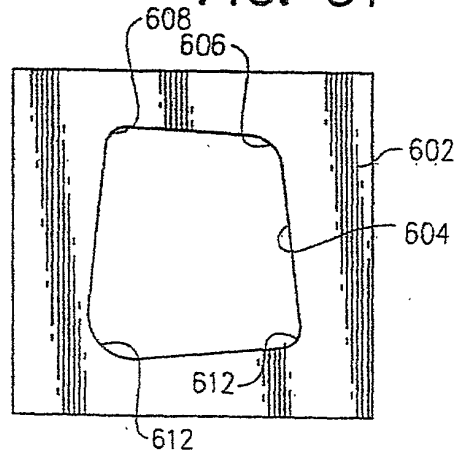
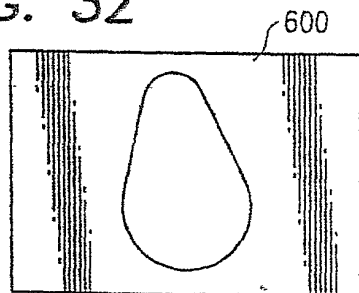


FIG. 32



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FIG. 35

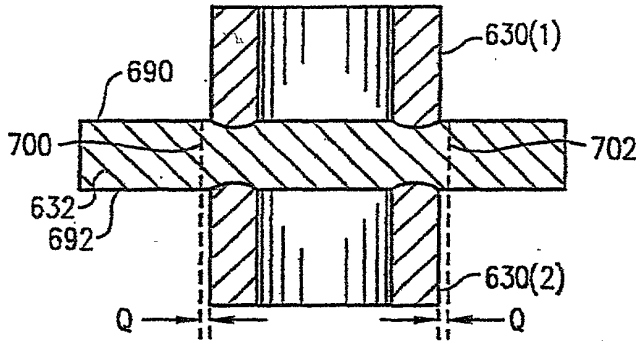


FIG. 36

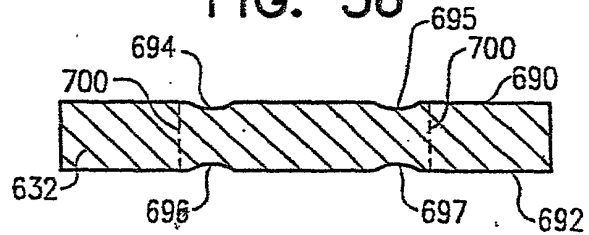


FIG. 37

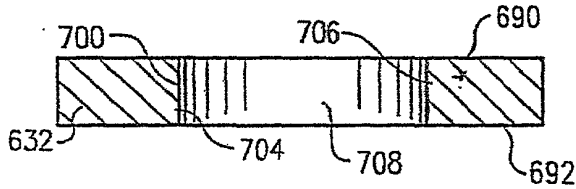


FIG. 48

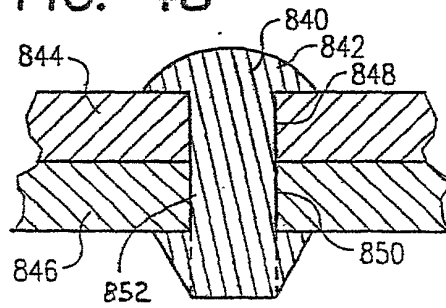
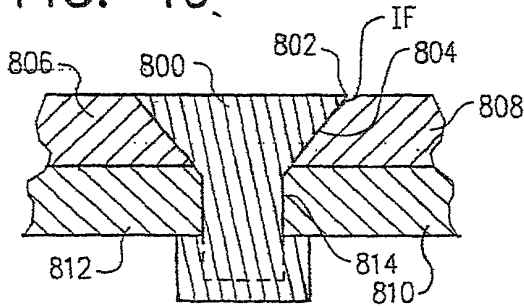


FIG. 49



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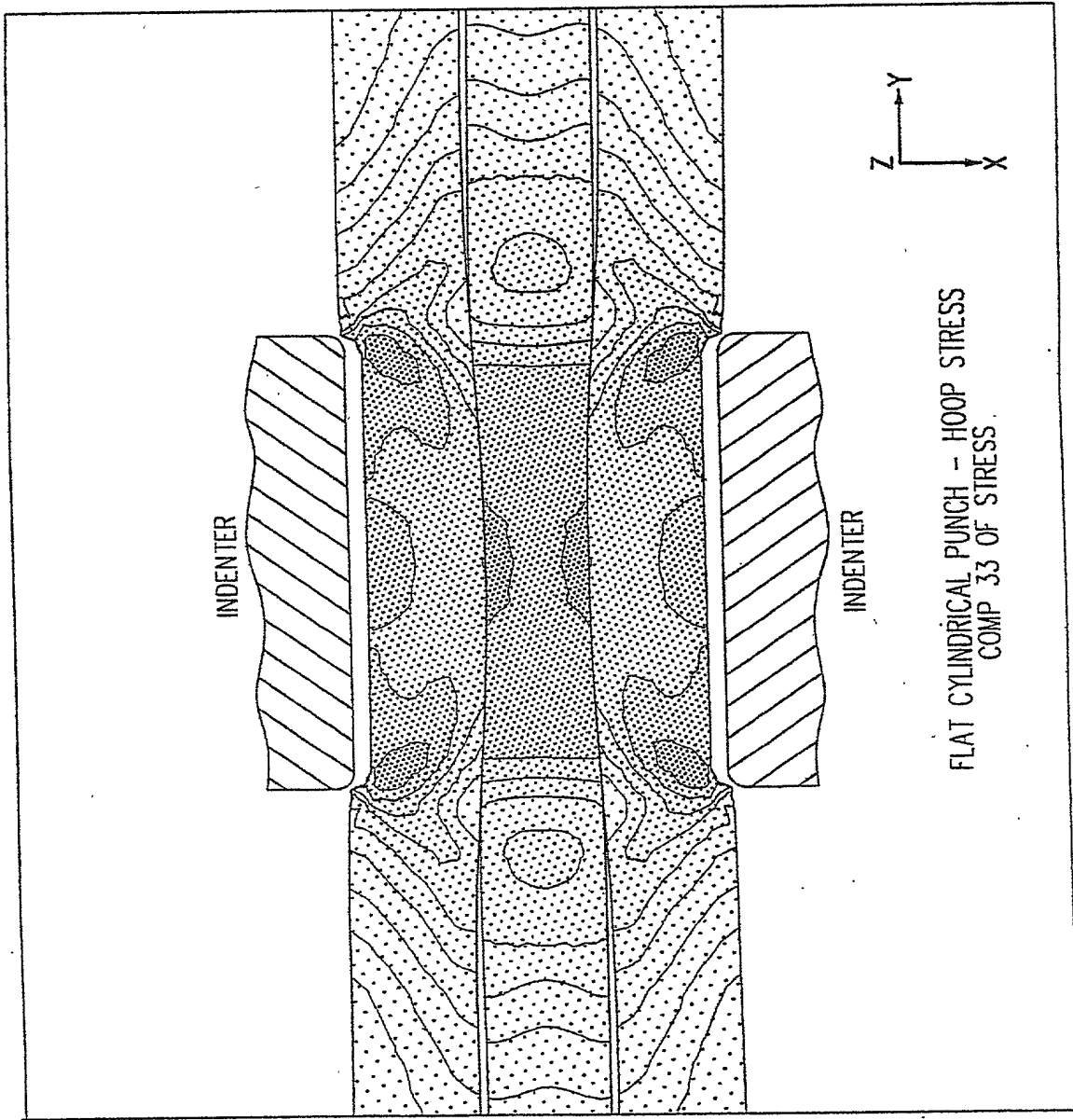
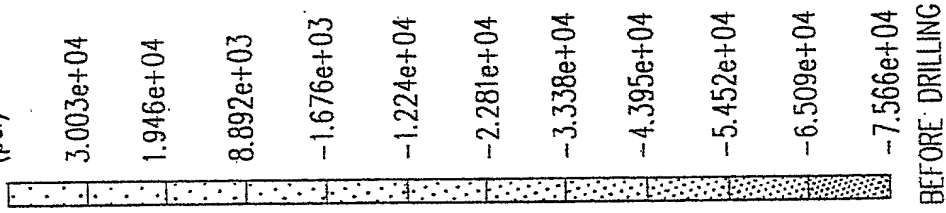
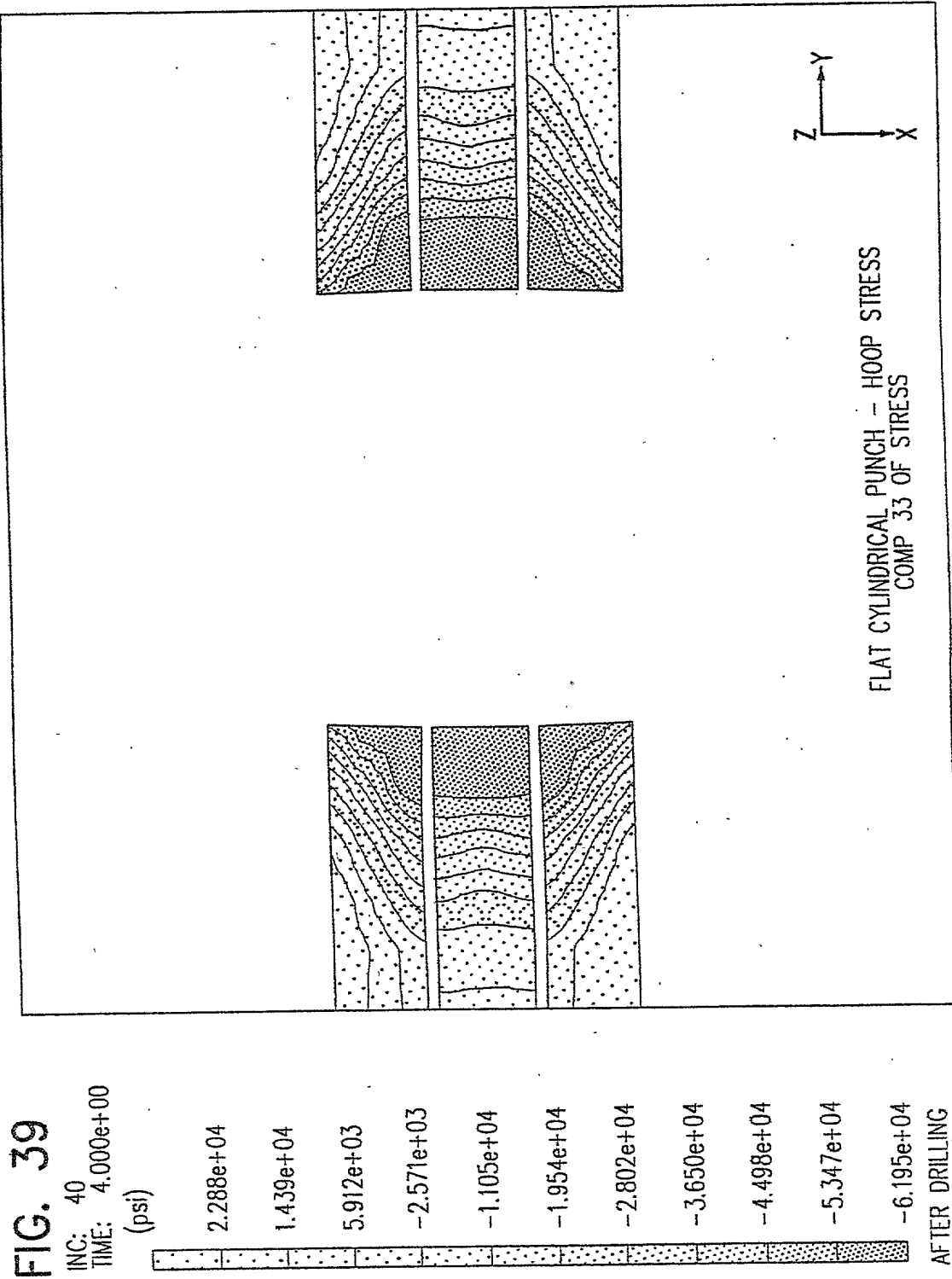


FIG. 38

INC: 30
TIME: 2.000e+00
(psi)

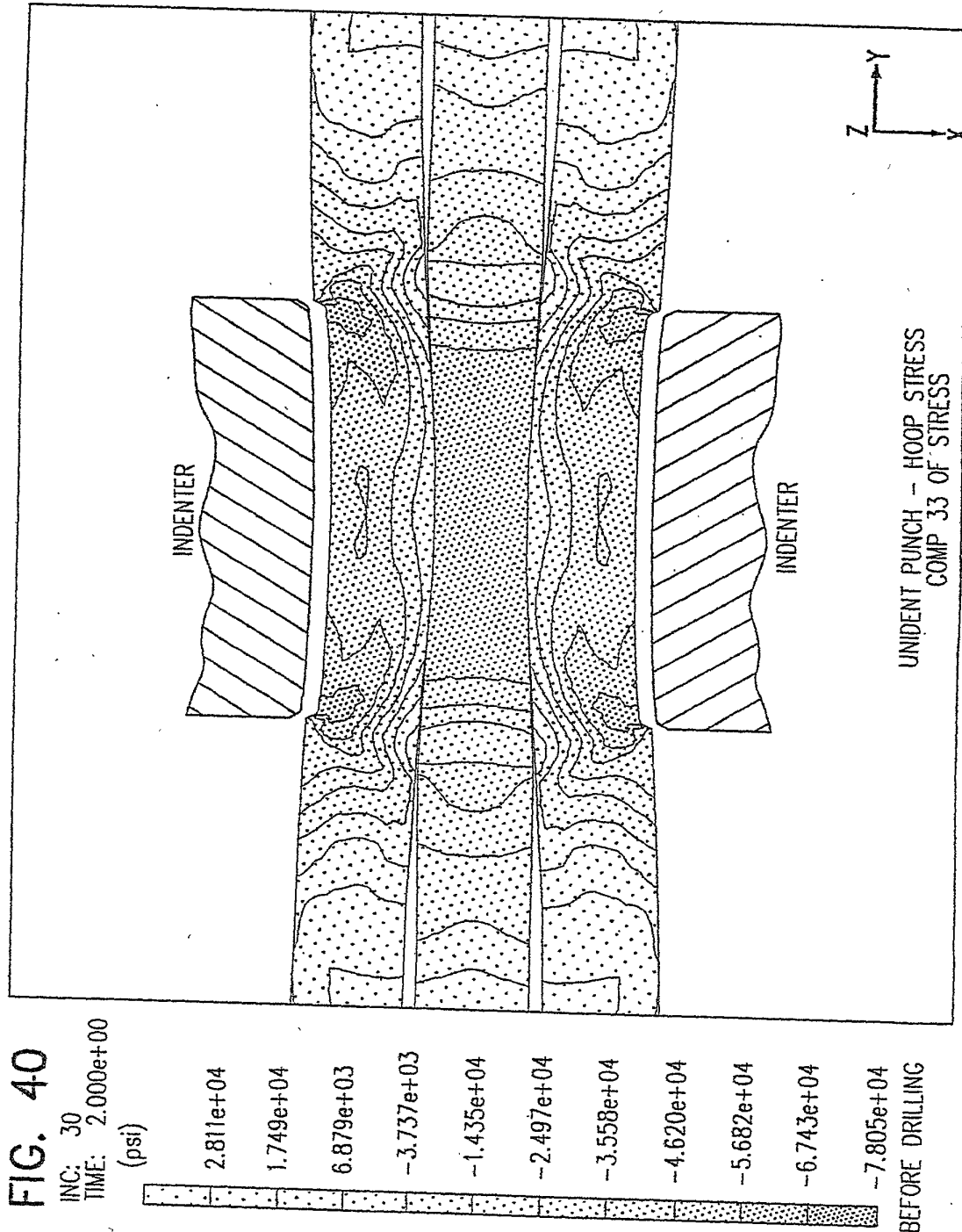


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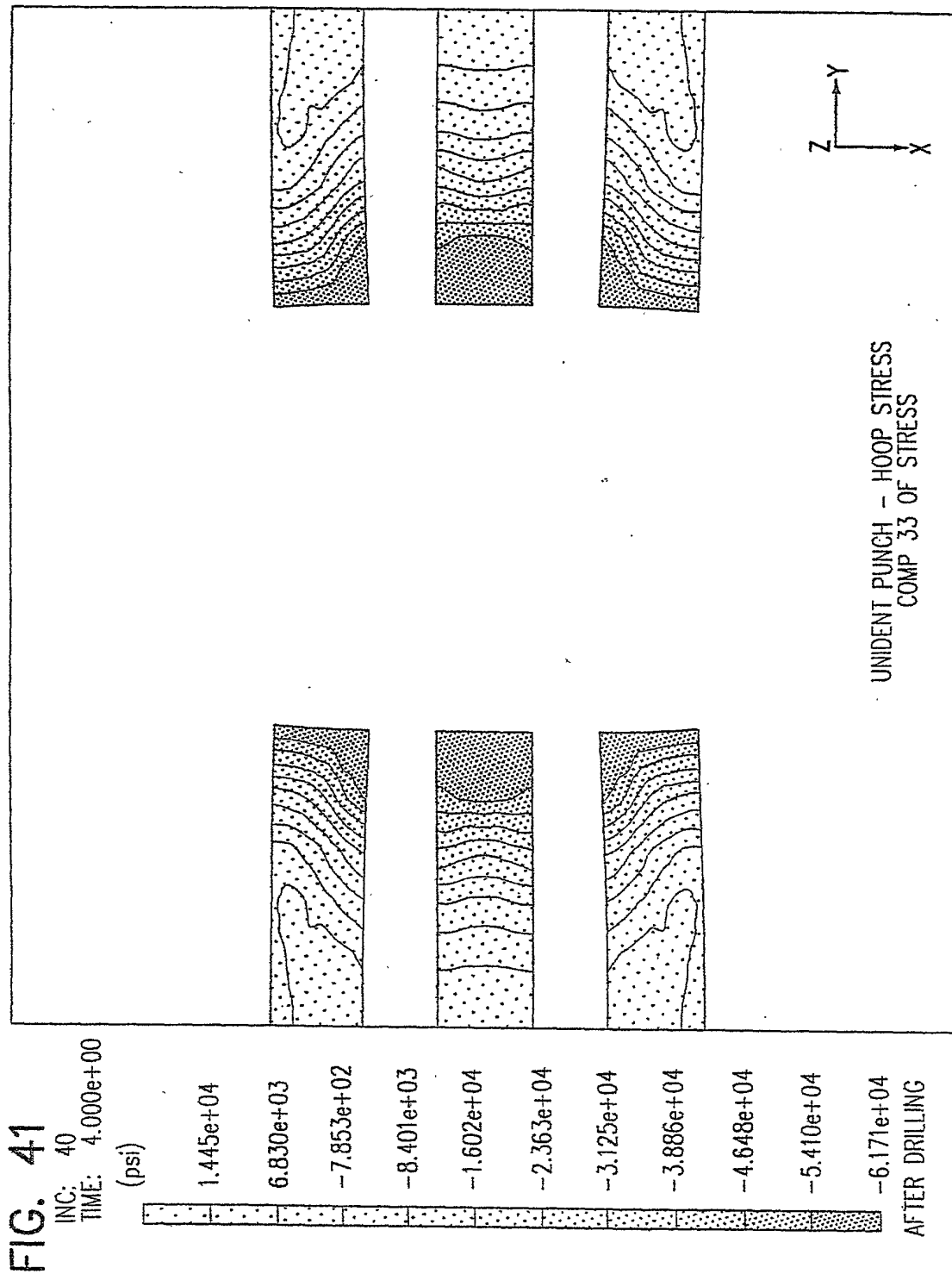
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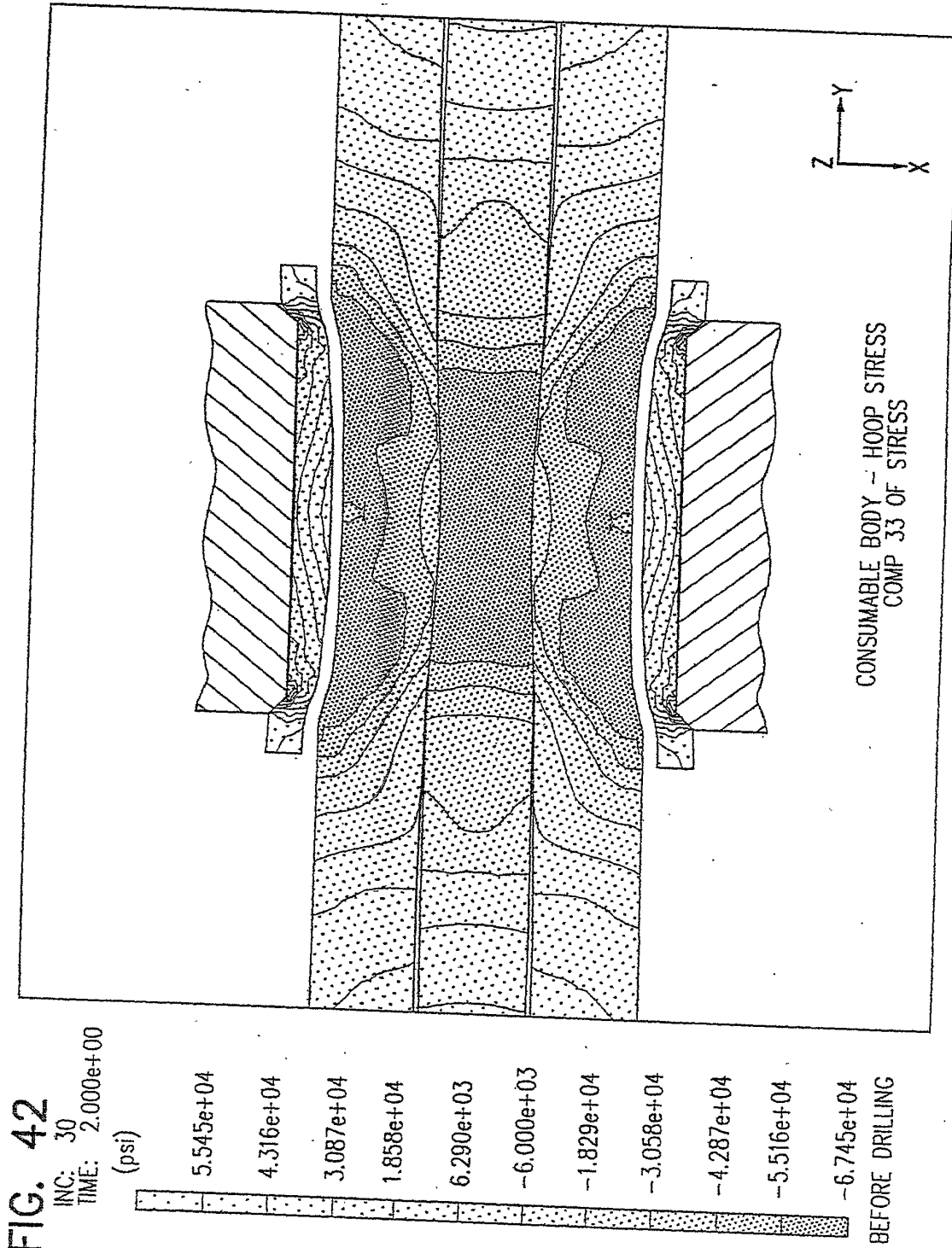


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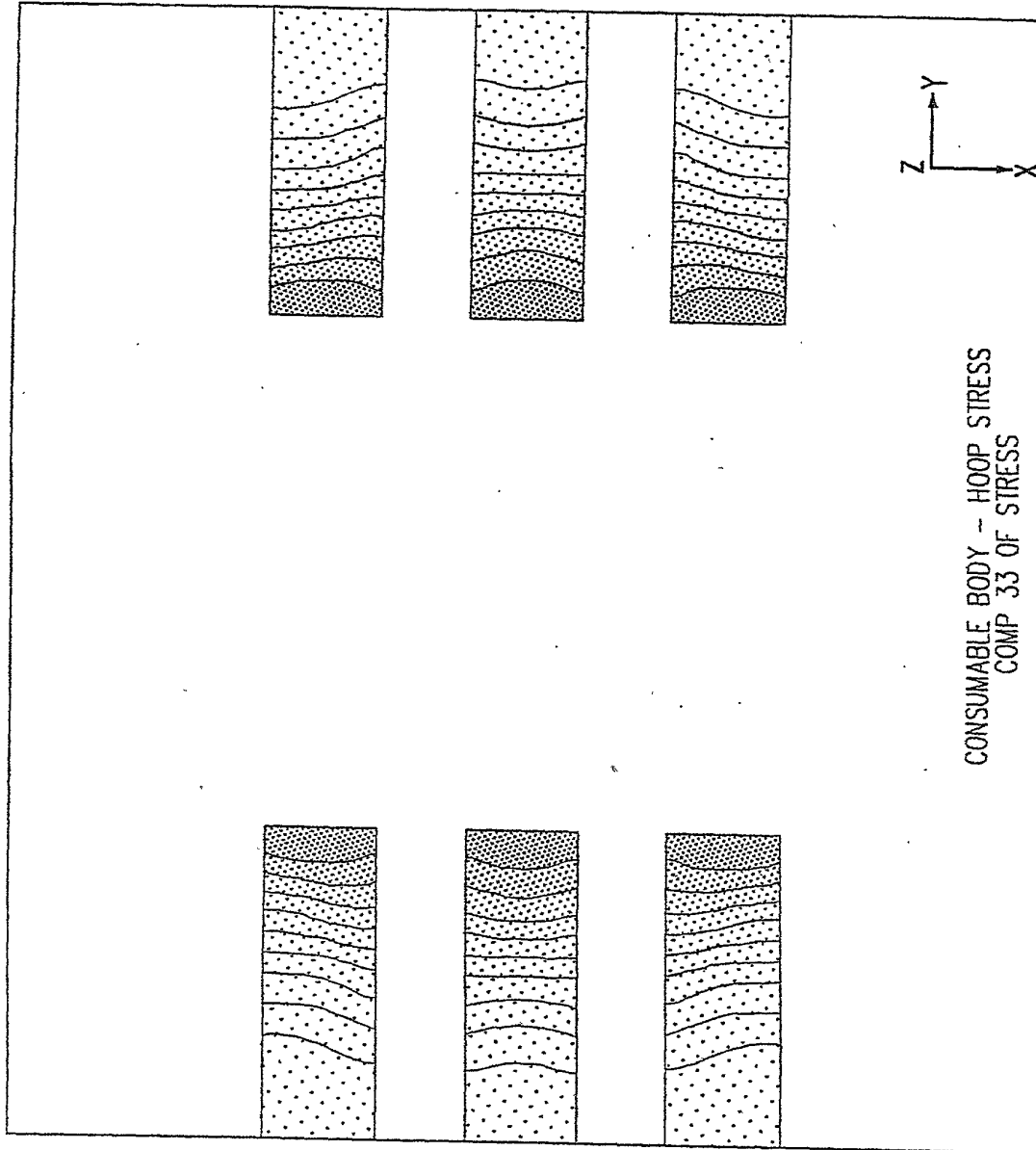
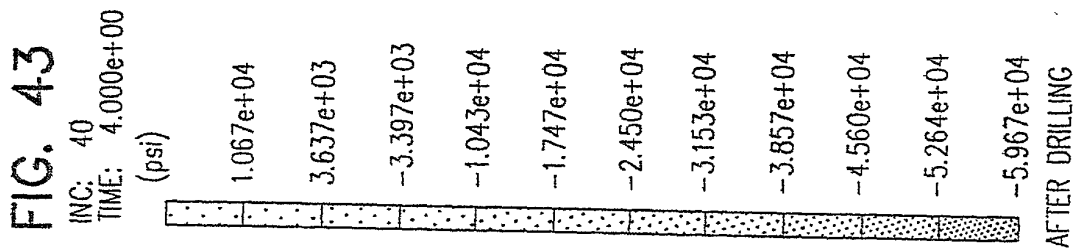
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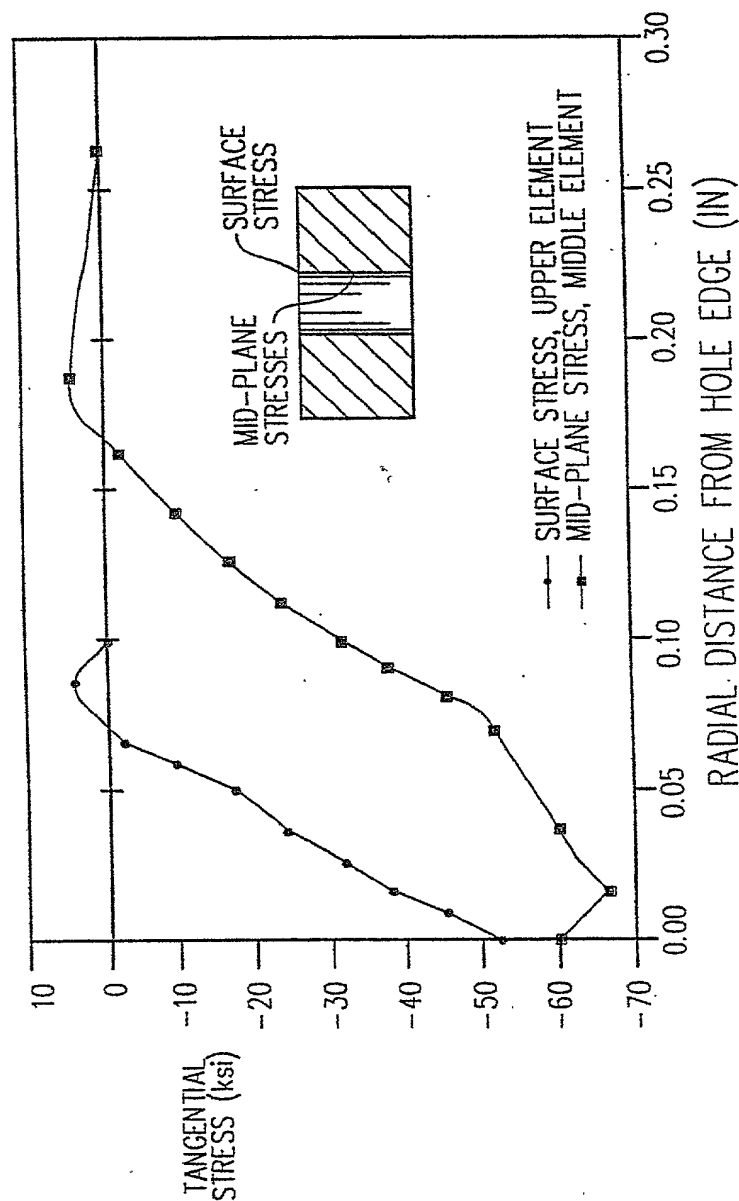
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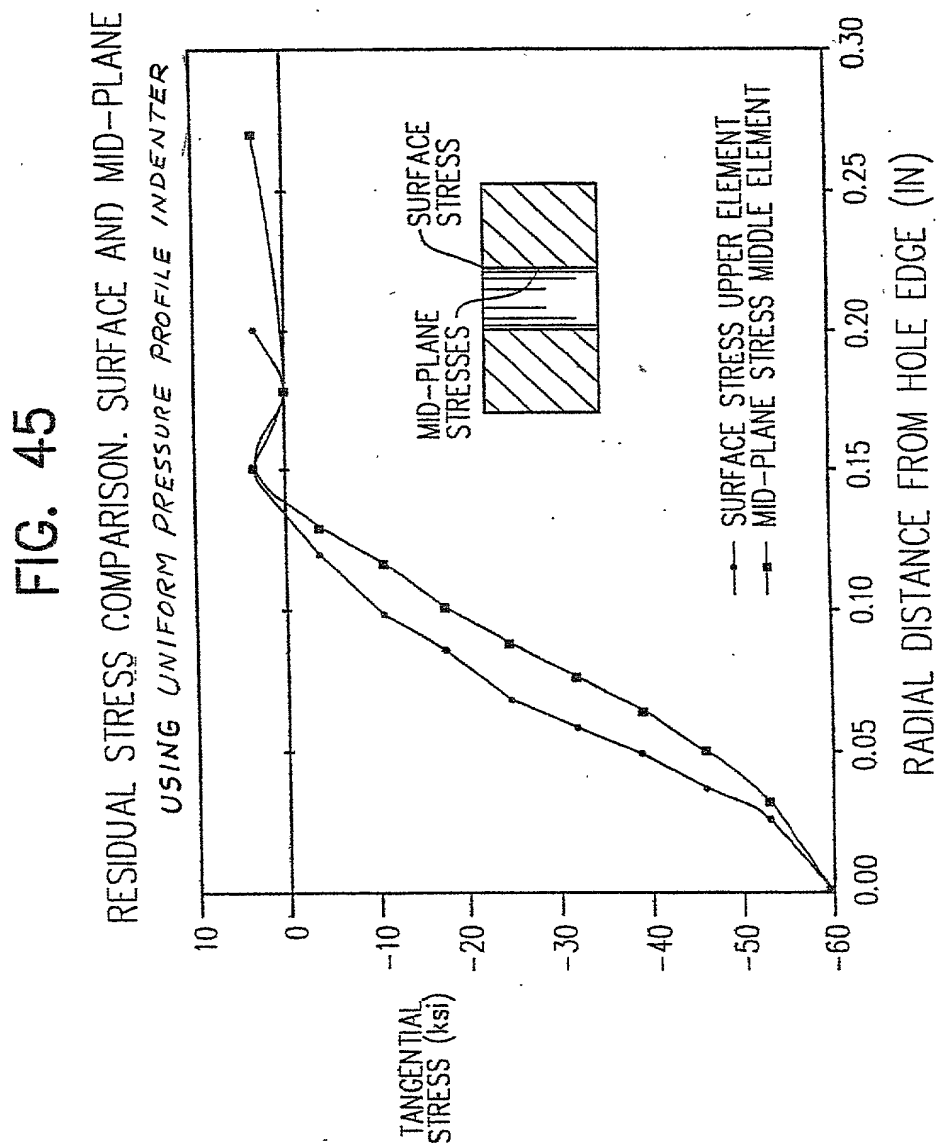
20070708 04:59:00

FIG. 44
 PRIOR ART

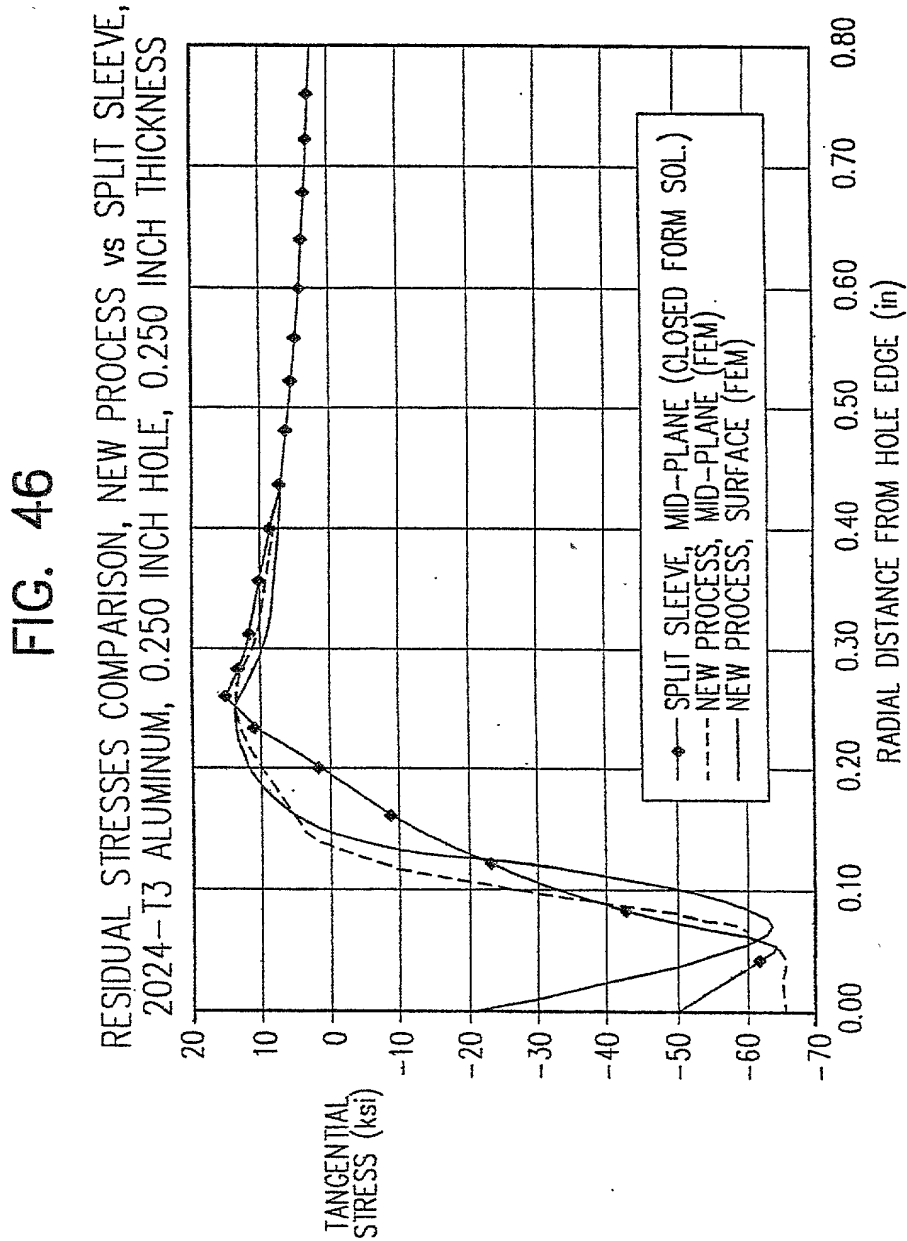
RESIDUAL STRESS COMPARISON, SURFACE AND MID-PLANE
 FLAT BOTTOMED CYLINDRICAL MANDREL



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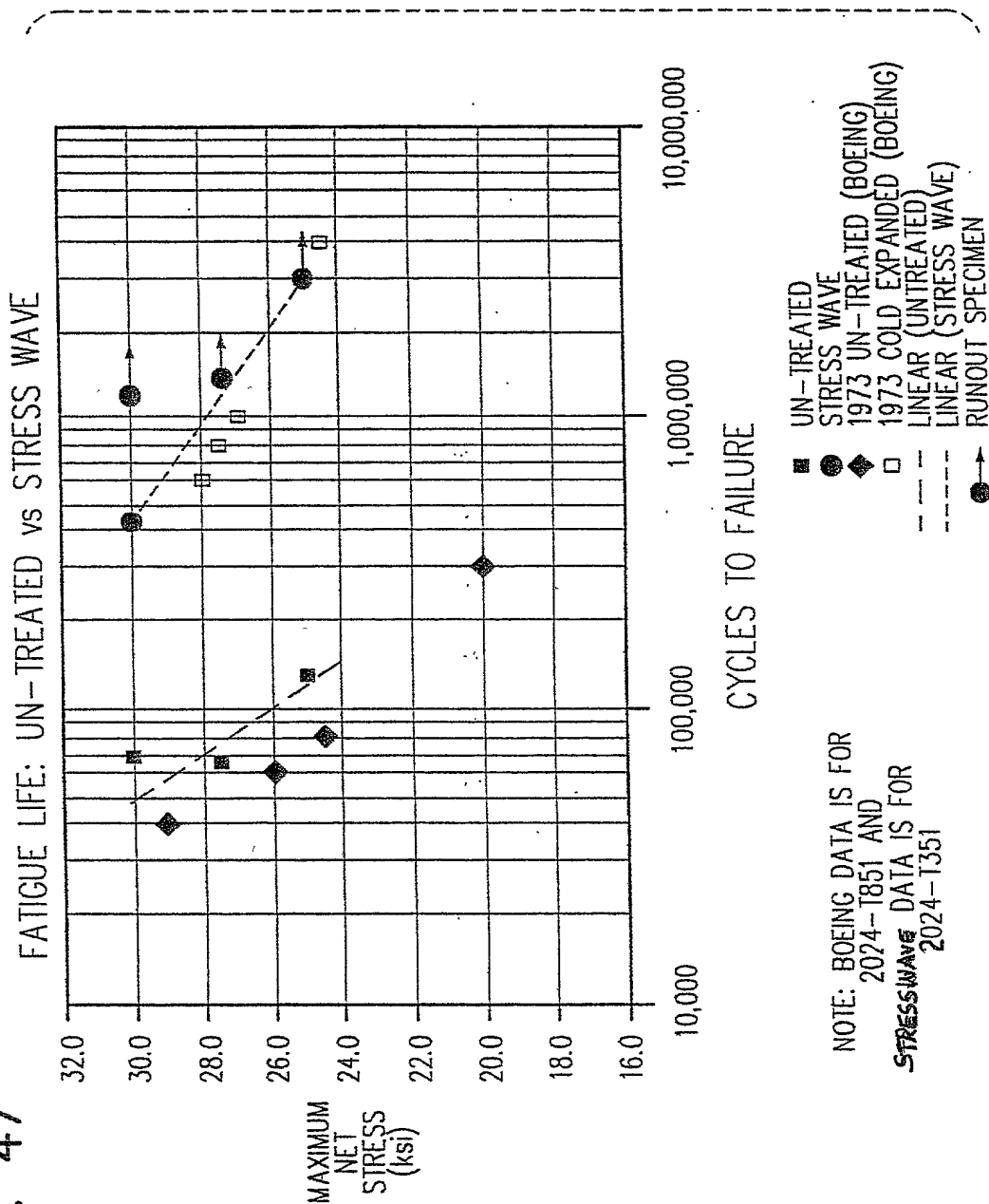


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FIG. 47



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FIG. 50

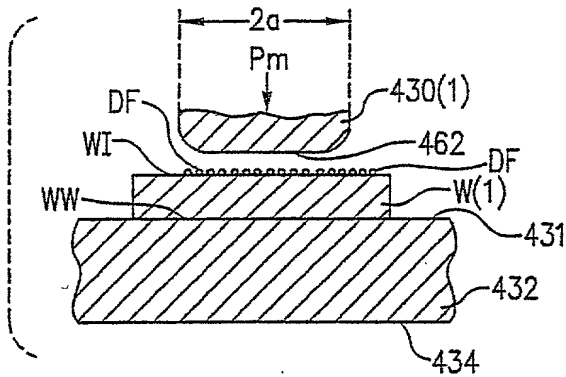


FIG. 52

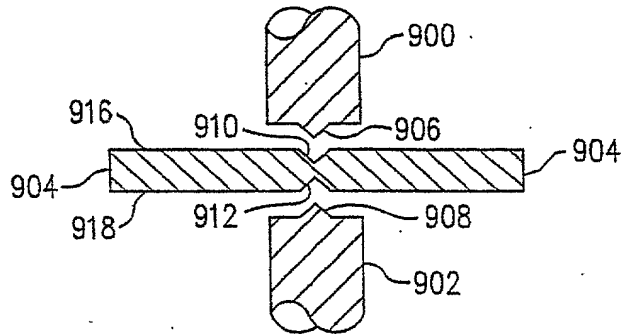


FIG. 53

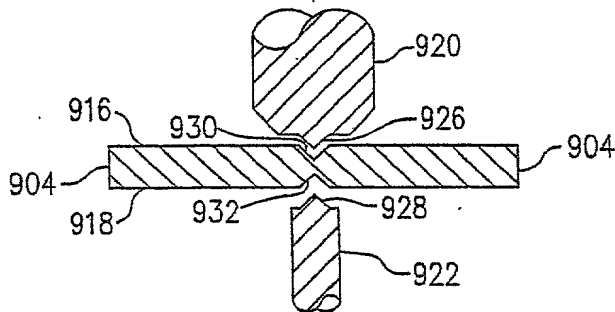
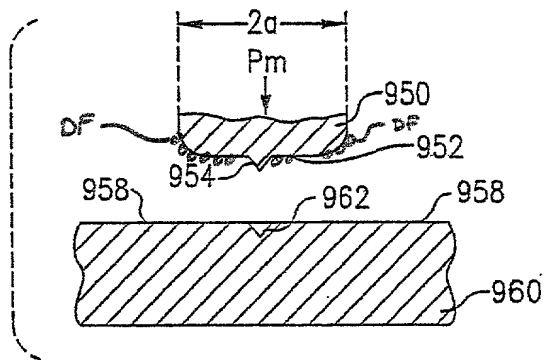


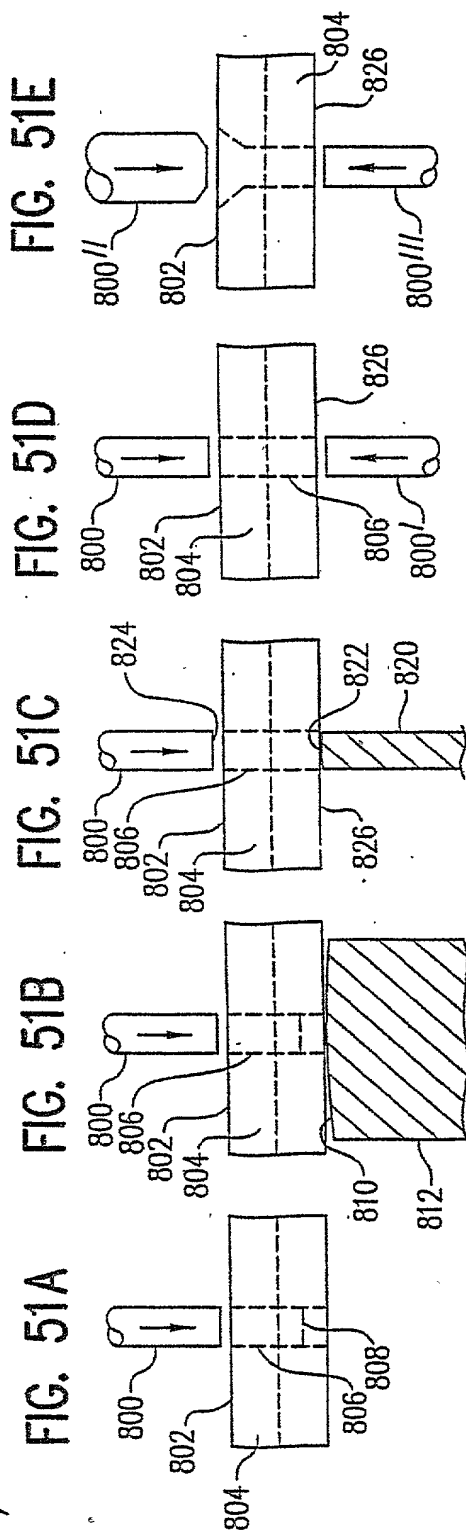
FIG. 54



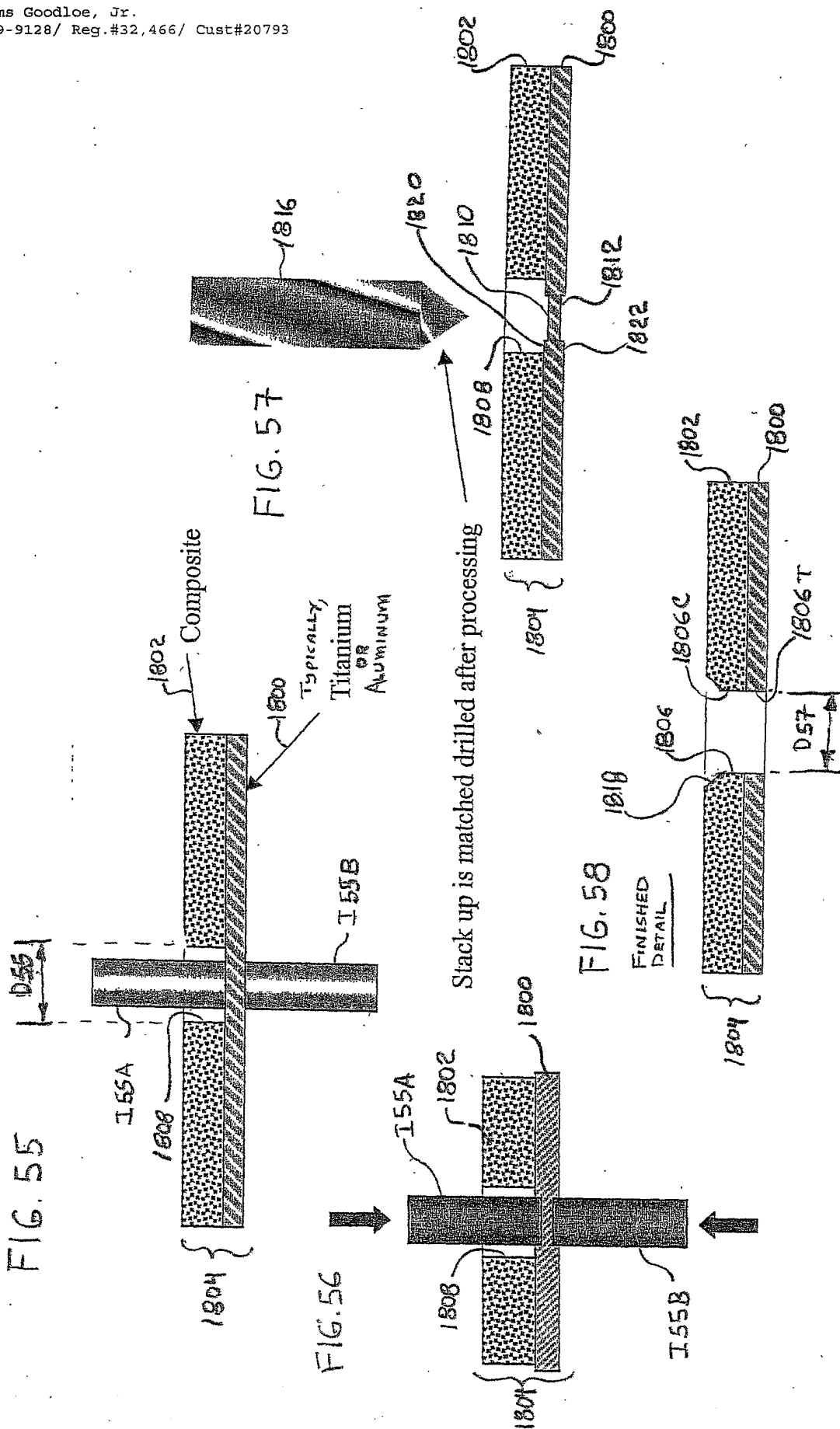
200810" 80495001

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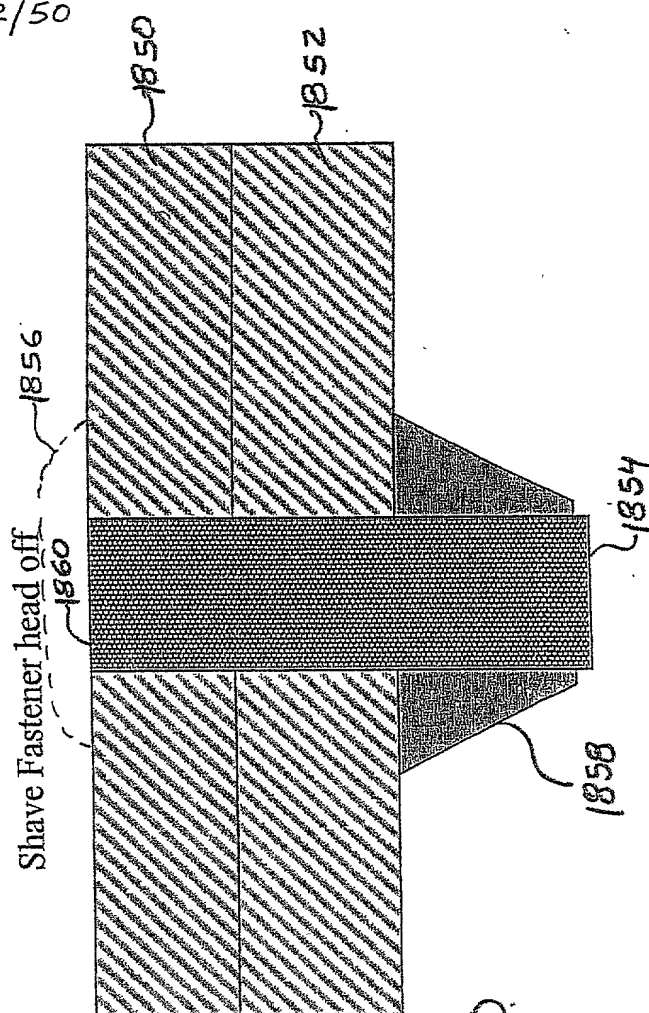
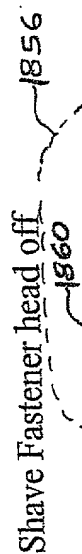
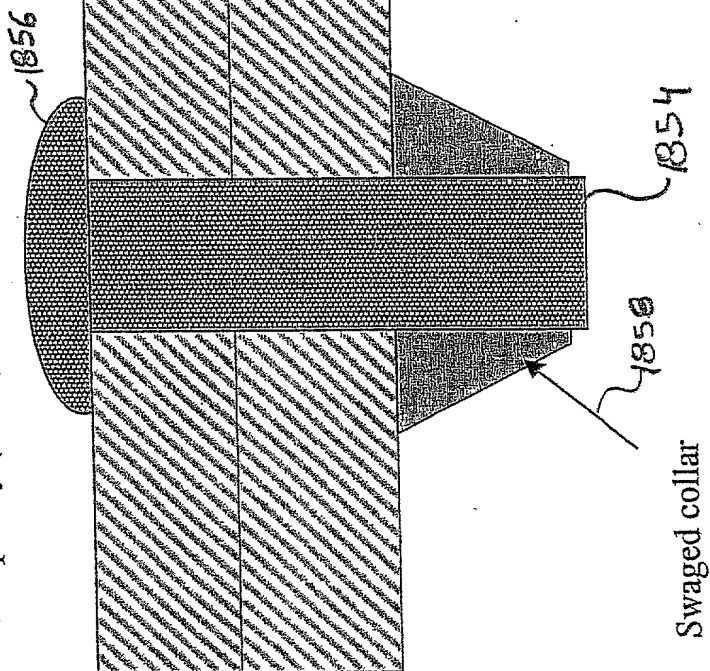
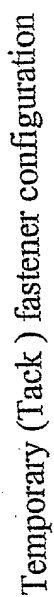
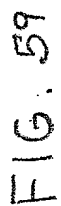
FIG. 51



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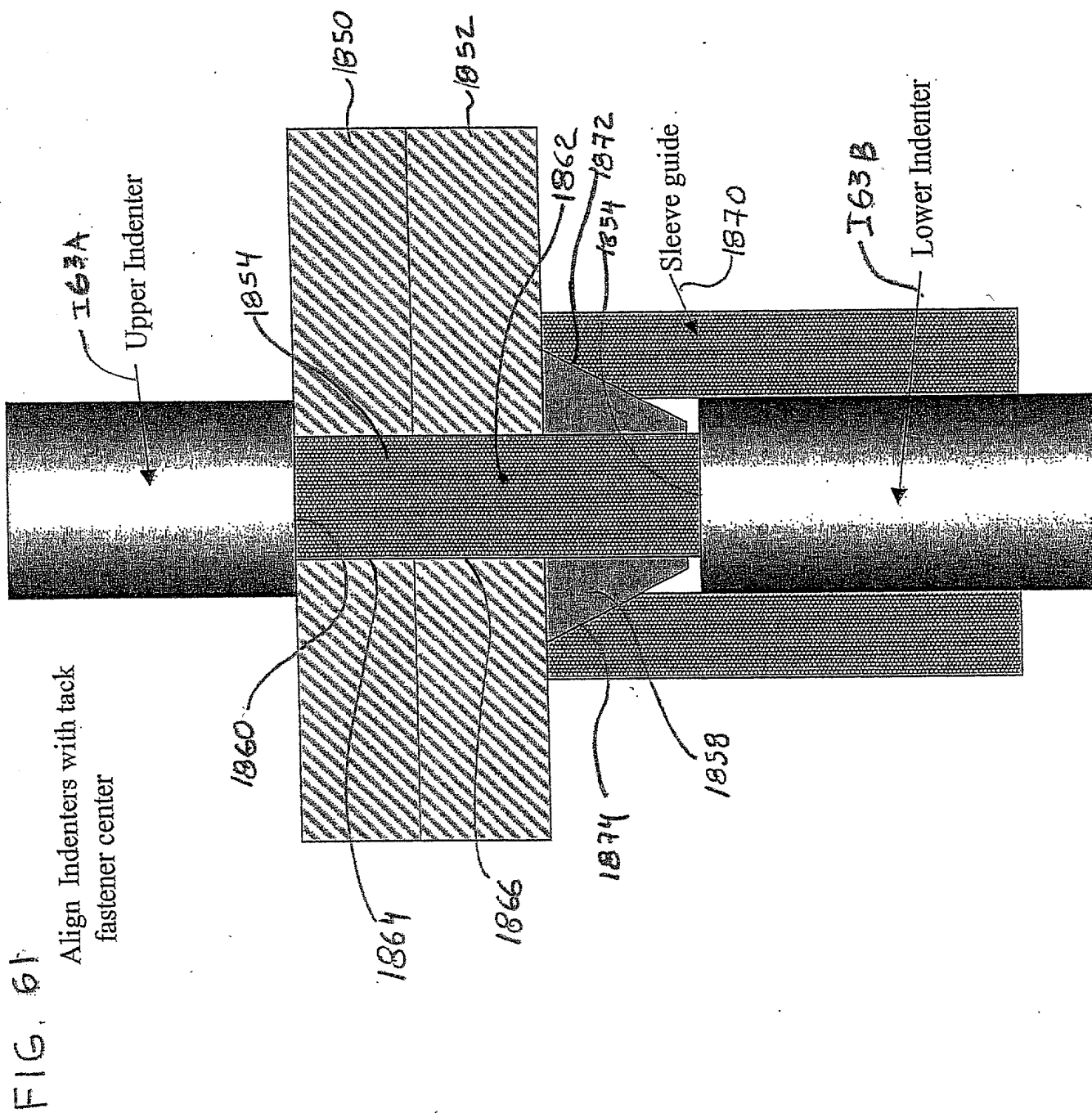


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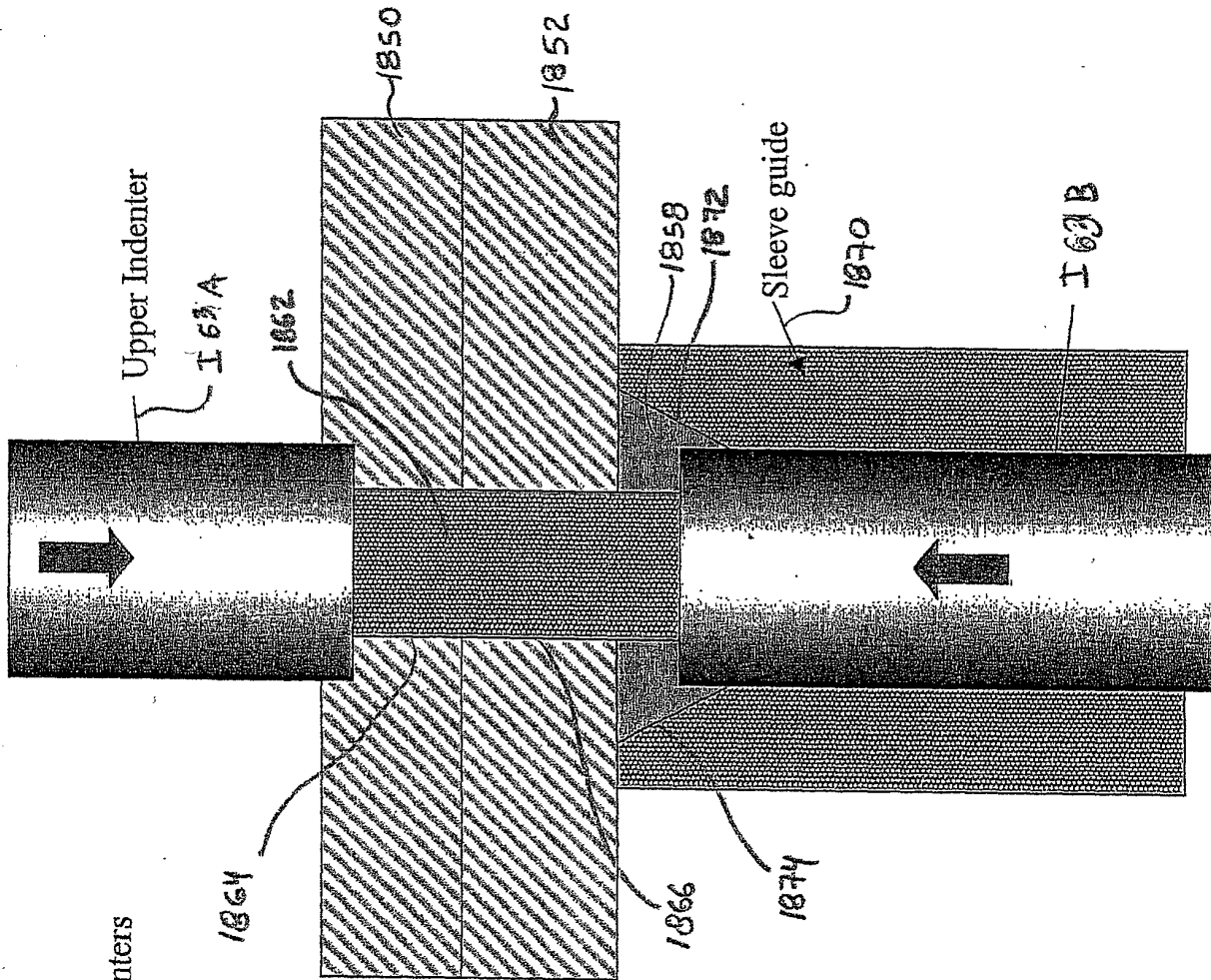
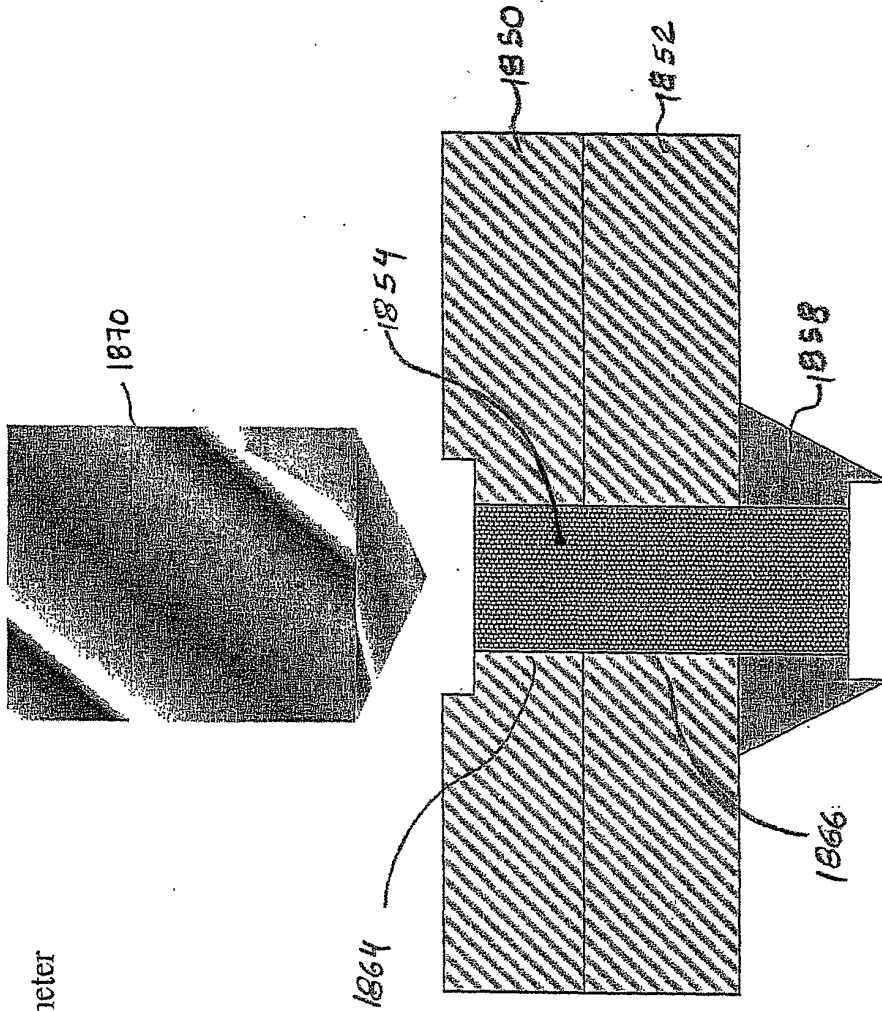


FIG. 63

Drill to bolt diameter



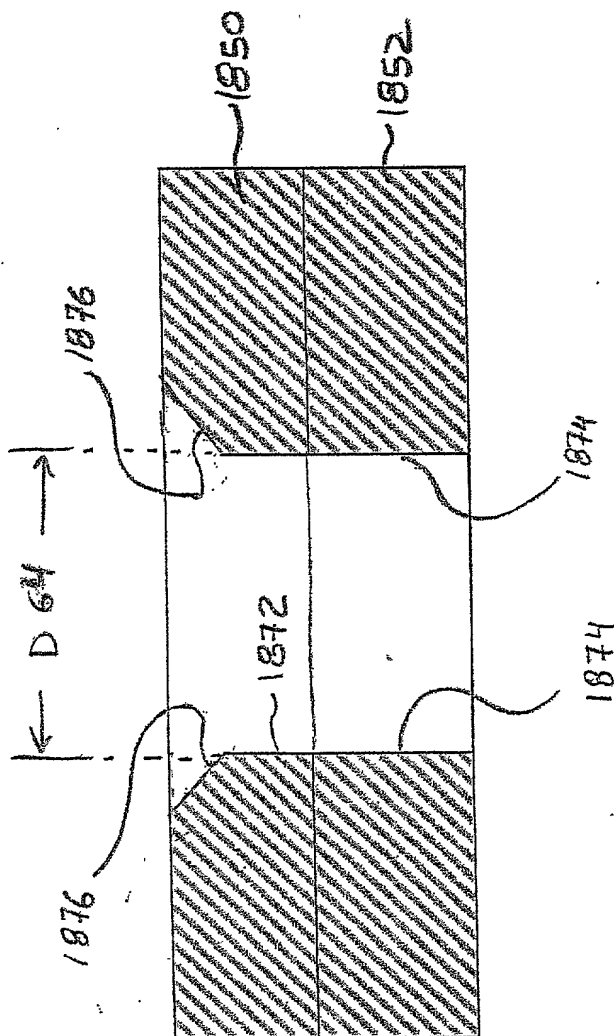
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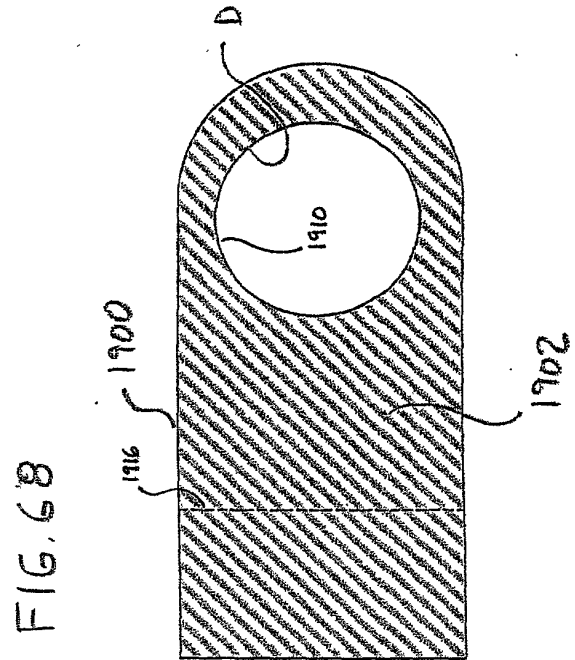
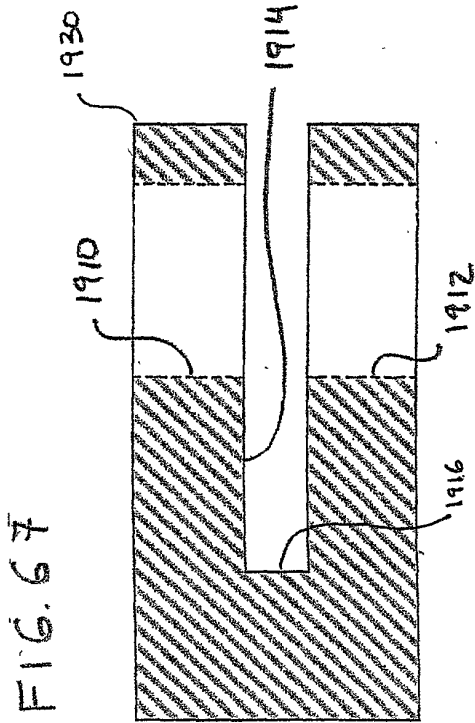
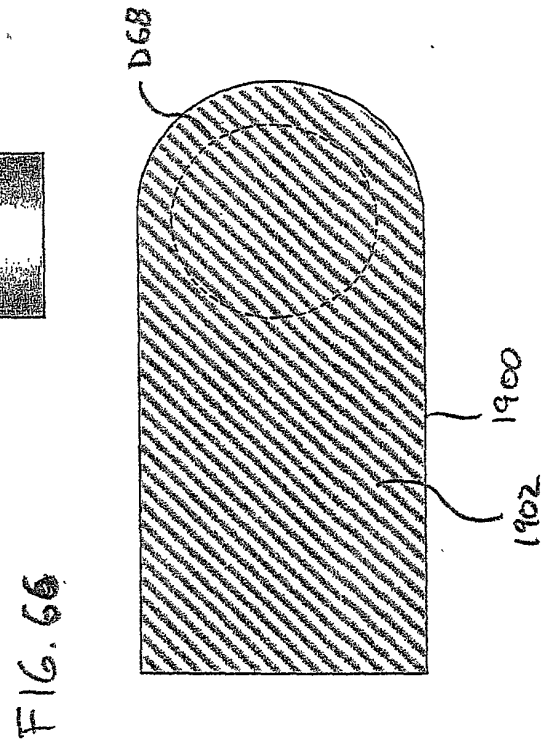
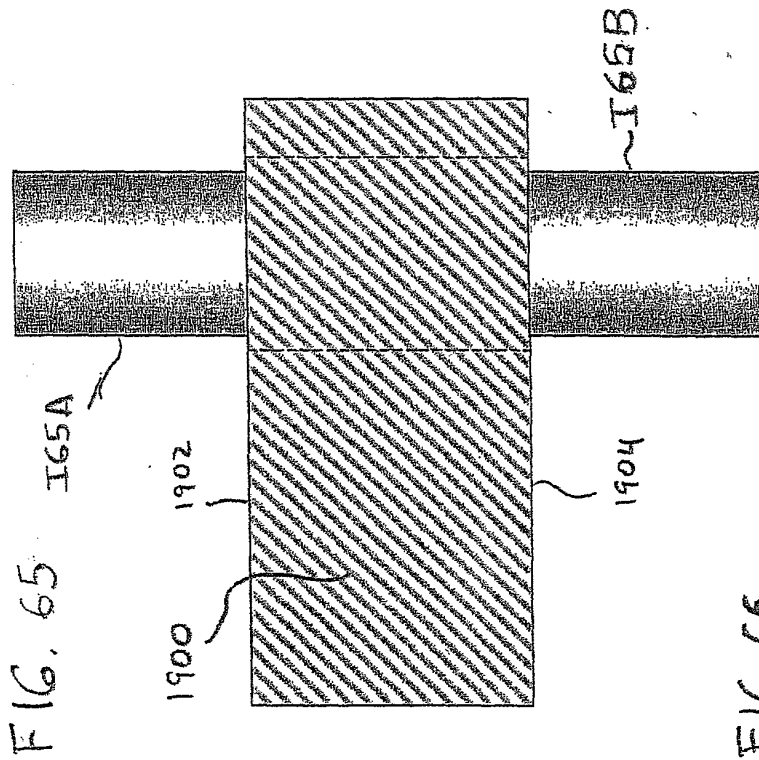
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FIG. 64

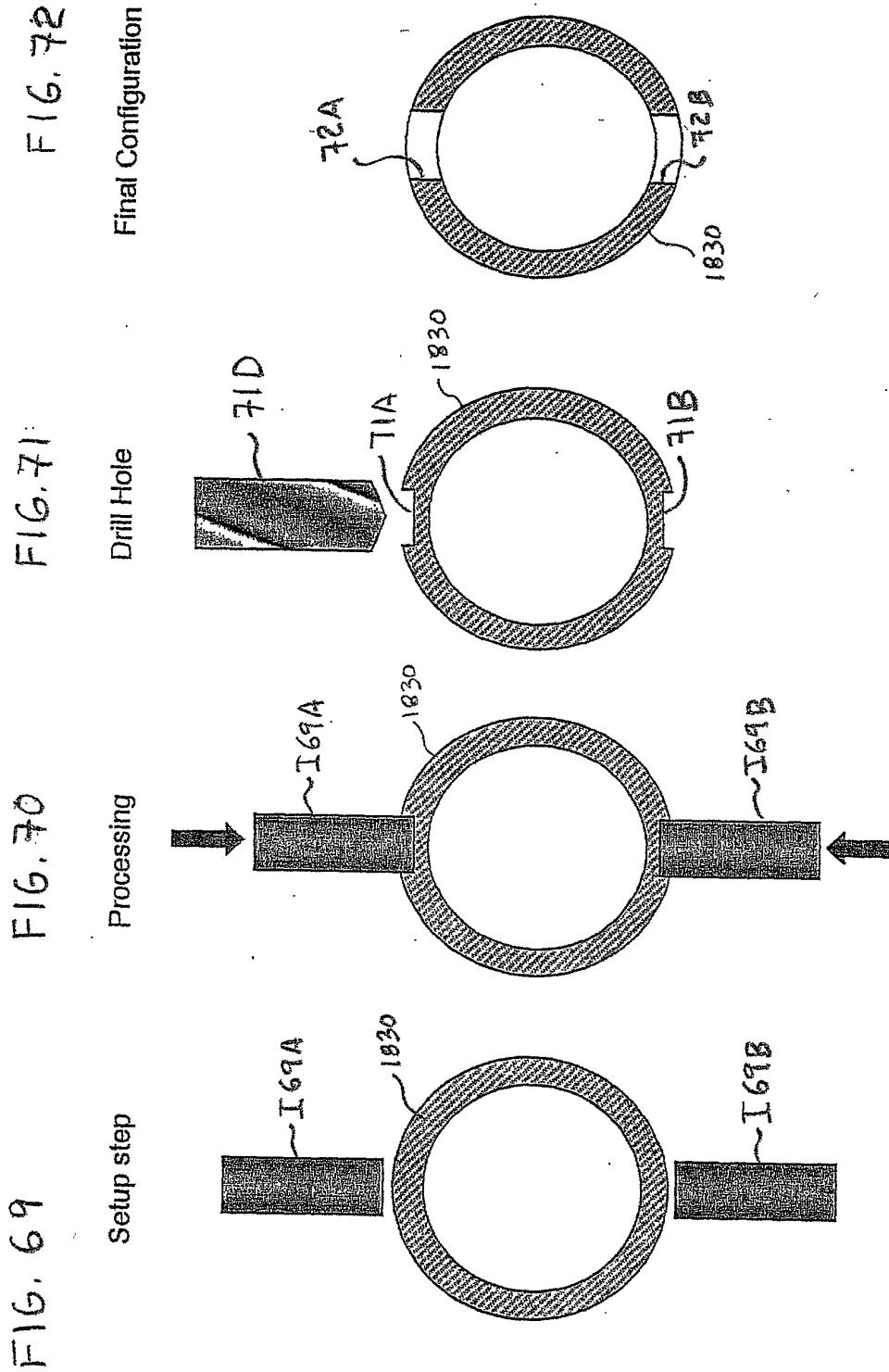
Finished treated hole



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Treatment of a tubular bar without internal support

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FIG. 73

Cross-Sectional view of processing step

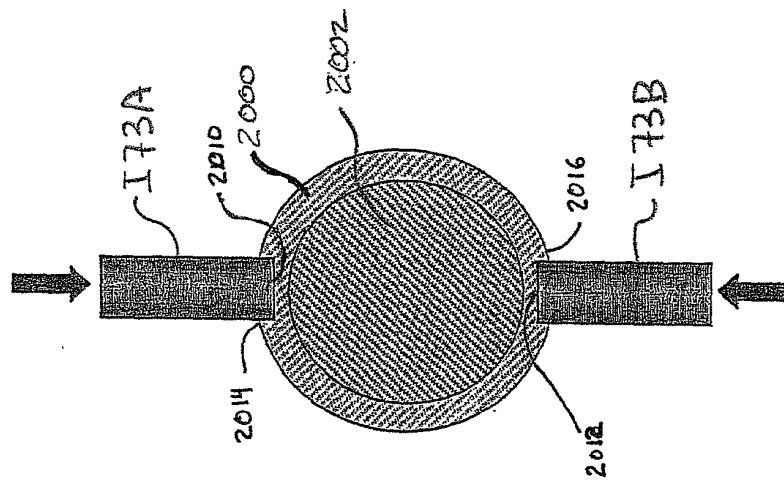
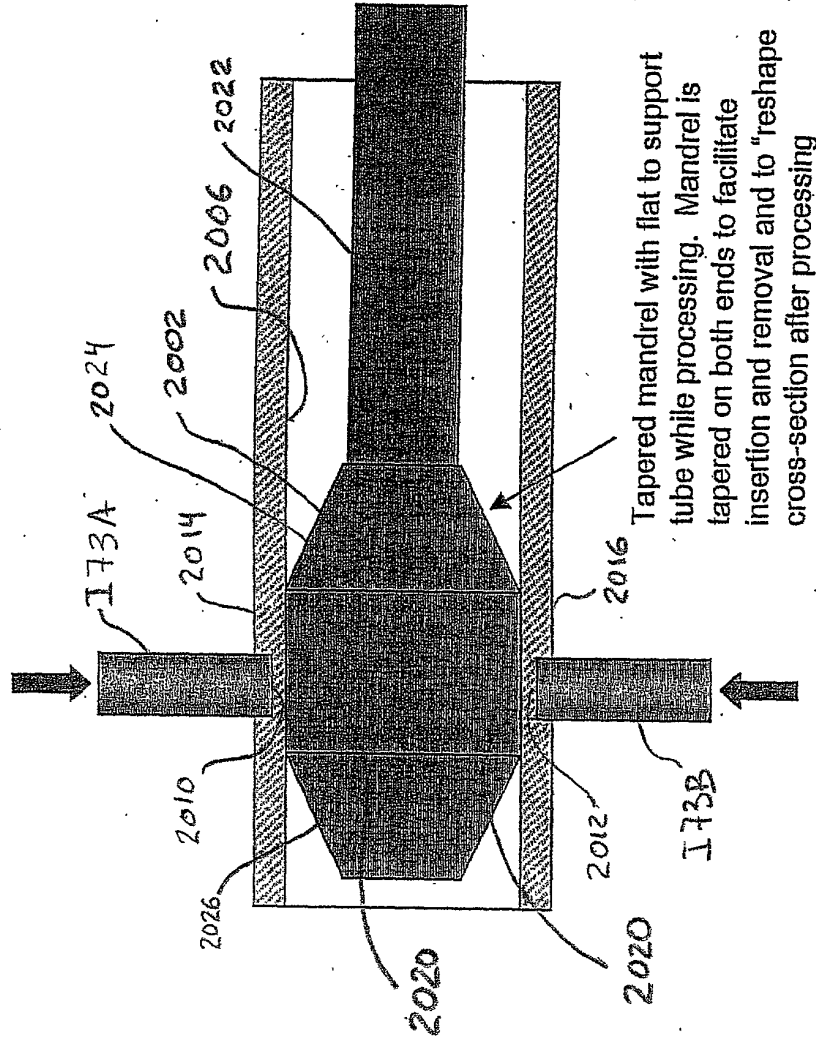


FIG. 74

Longitudinal cross-sectional view of processing step



Treatment of a tubular bar with internal support

Cross section of hollow tube treated with indenter end shape that conforms to tube diameter

FIG. 75

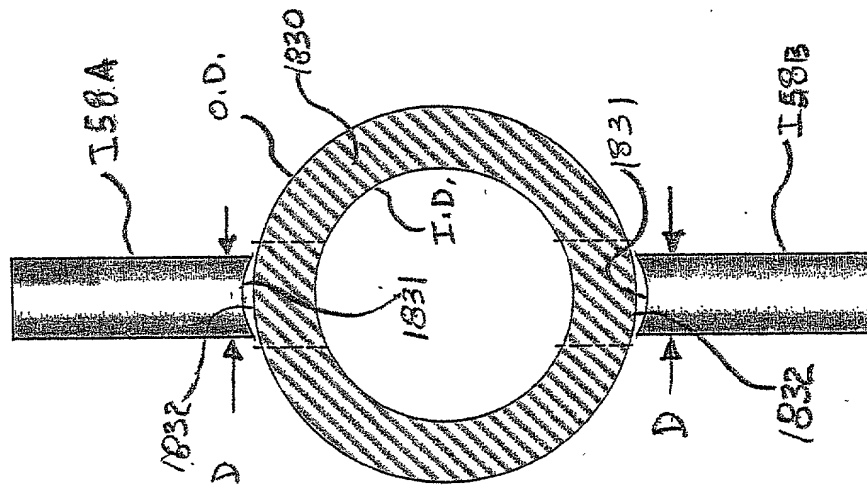
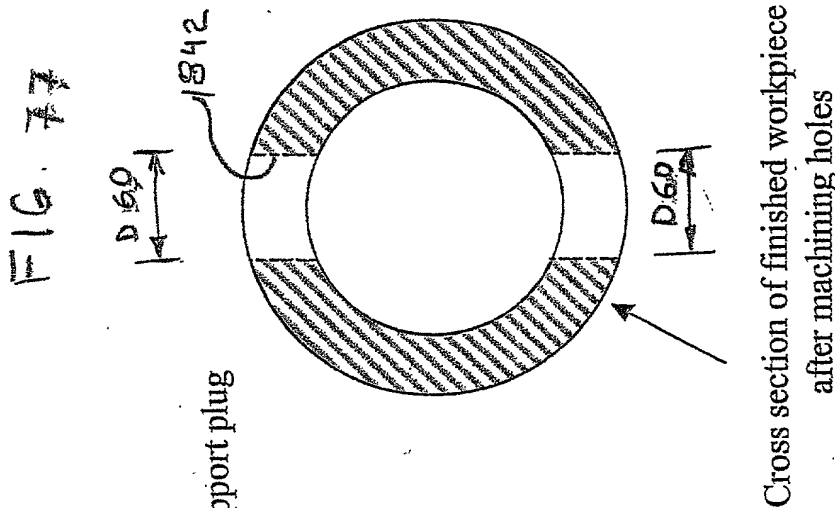
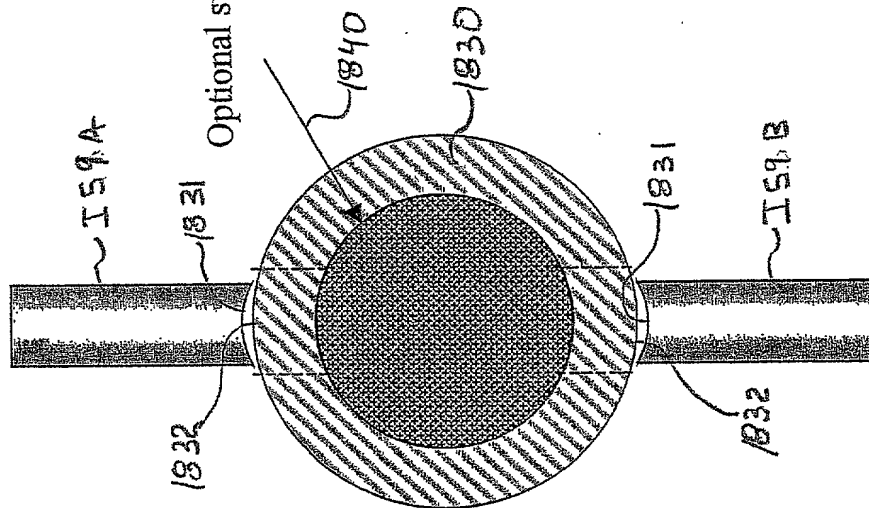


FIG. 76



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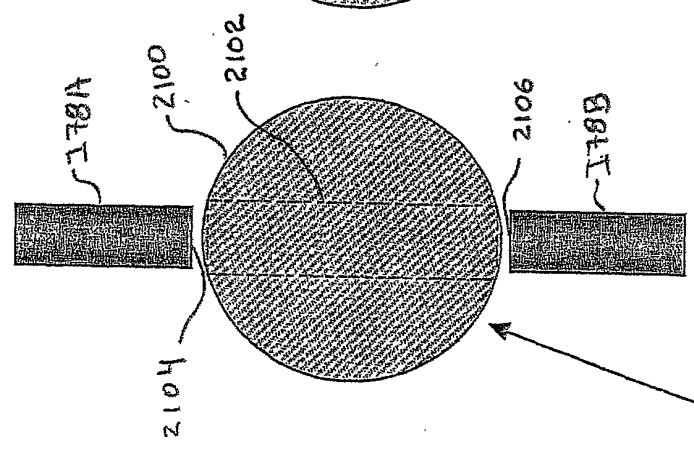
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FIG. 78 FIG. 79 FIG. 80

Setup step

Processing

Drill Hole



Cross section of round bar

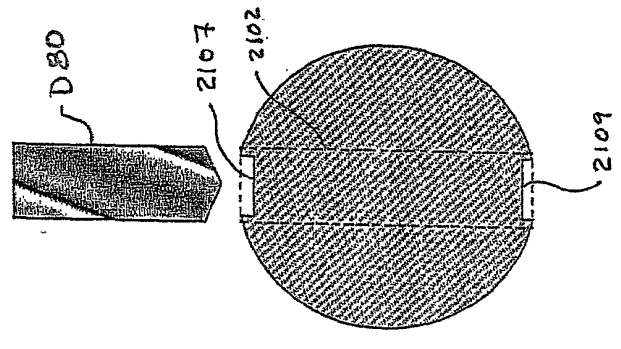
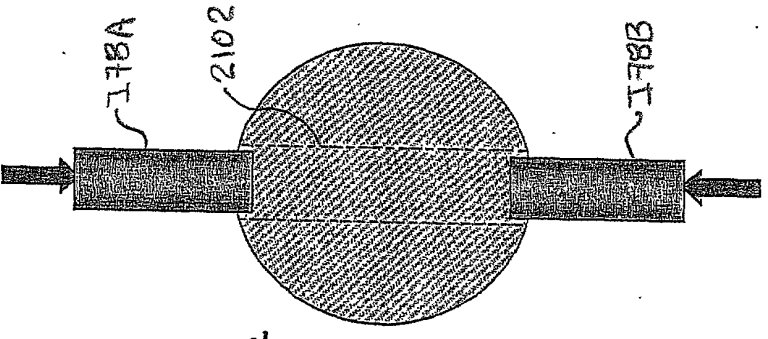
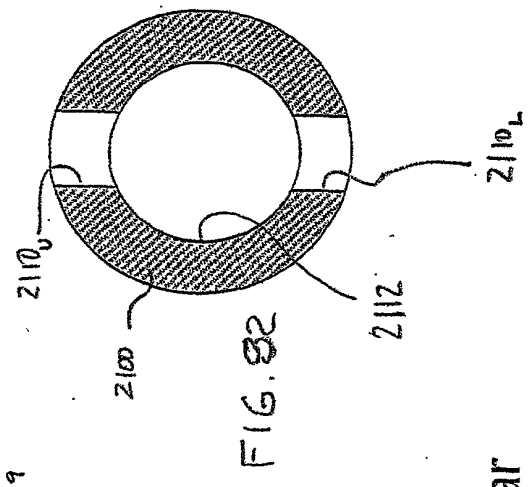
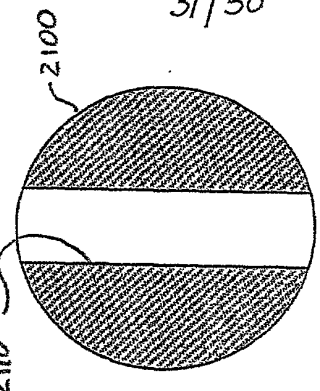


FIG. 81

Final Configurations



Treatment of a solid bar

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FIG. 83

Setup step

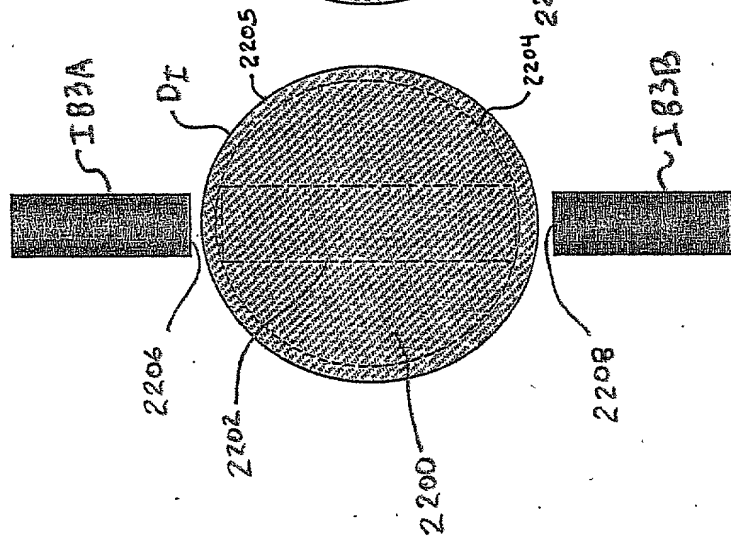


FIG. 84

Processing

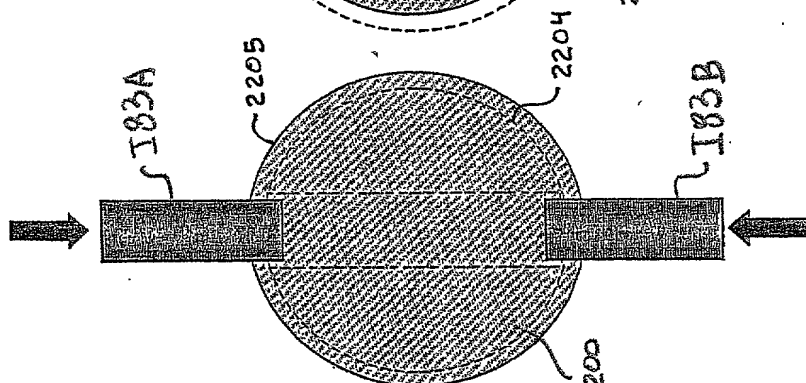


FIG. 85

Drill Hole

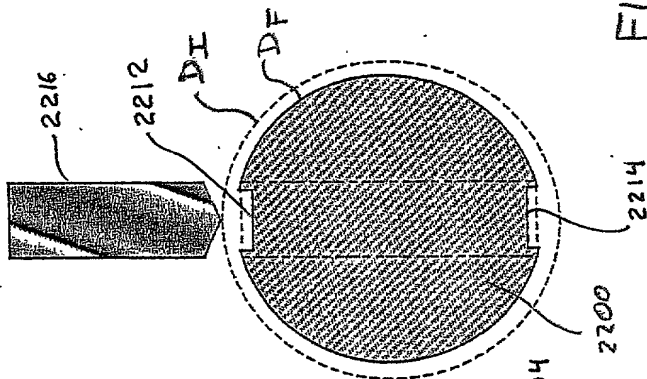


FIG. 86

Final Configurations

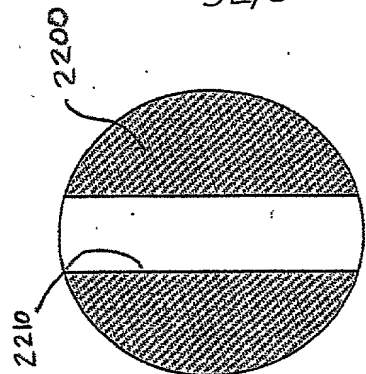
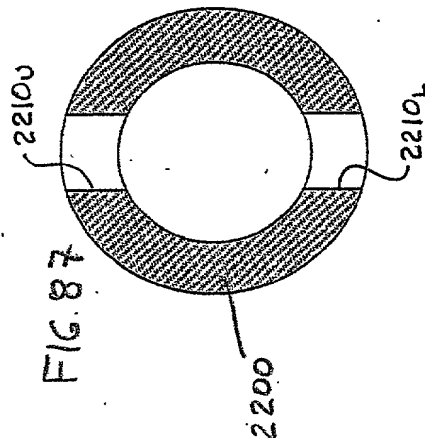


FIG. 87



Treatment of an initially oversized solid bar

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FIG. 88

Setup step

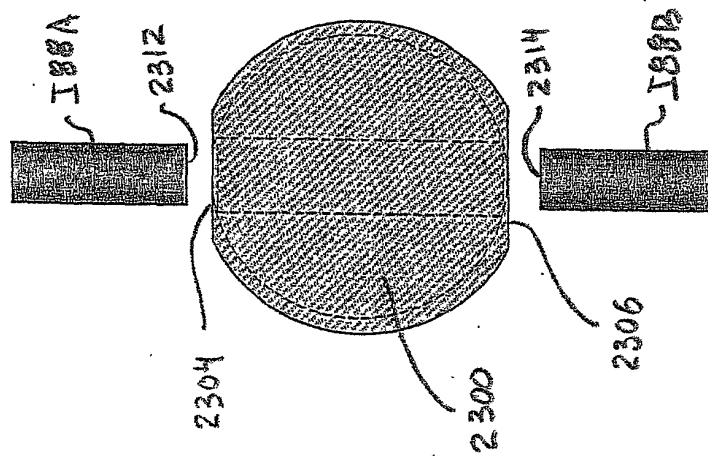


FIG. 89

Processing

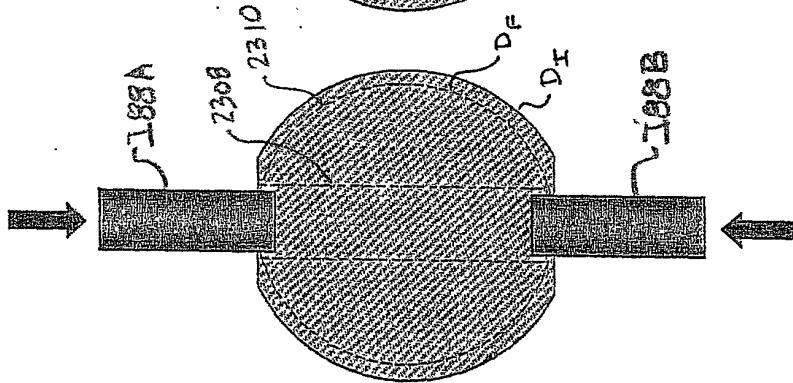


FIG. 90

Drill Hole

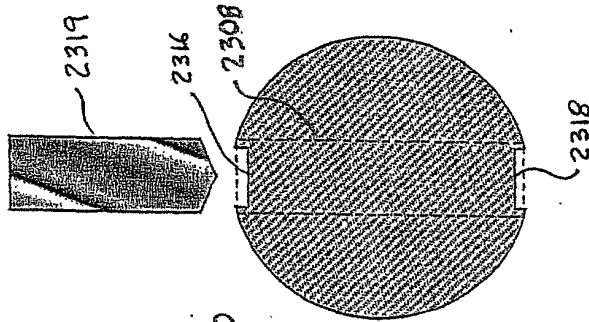


FIG. 91

Final Configurations

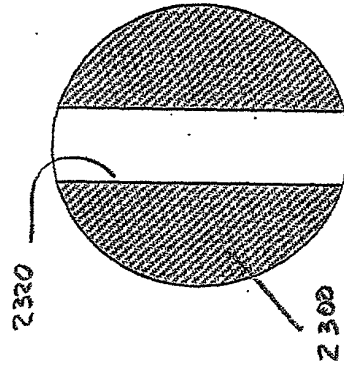
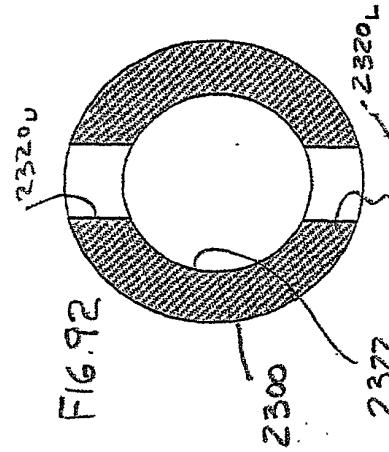


FIG. 92



Treatment of an initially oversized solid bar with
opposing "flats" to facilitate treatment

FIG. 93

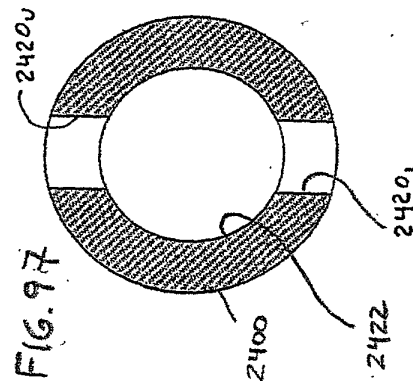
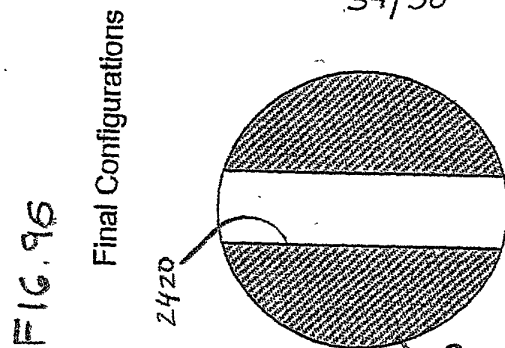
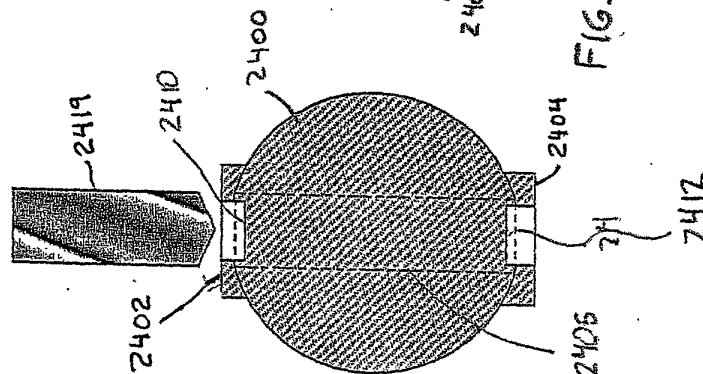
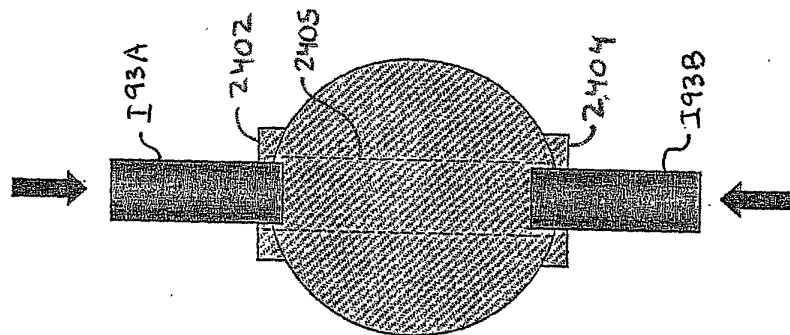
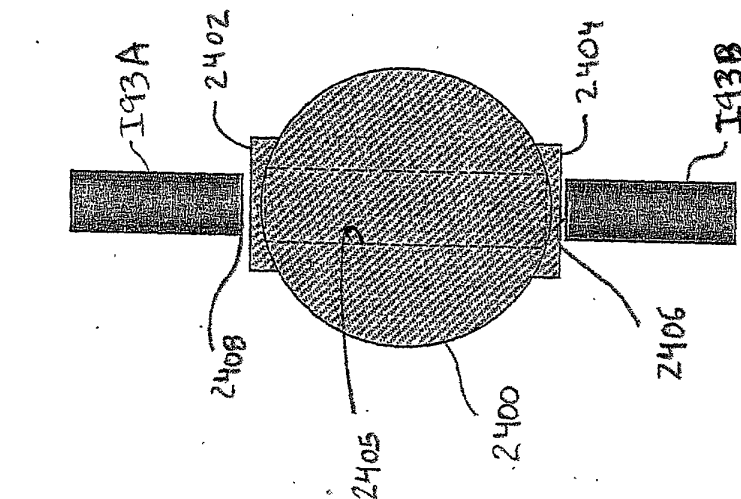
Setup step

FIG. 94

Processing

FIG. 95

Drill Hole



Treatment of a solid bar with milled or integral
"flats" to facilitate the process

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FIG. 98

Process setup step

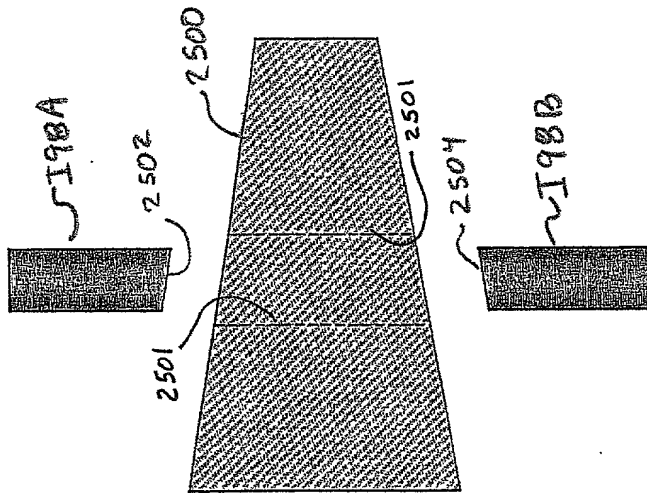
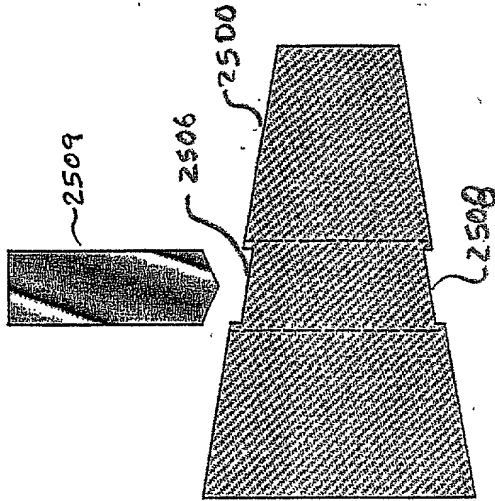


FIG. 99

Drill



Final configuration

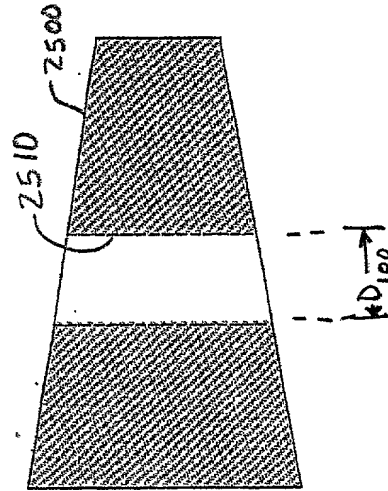


FIG. 100

Treatment of a structure with two tapered surfaces

[illegible]

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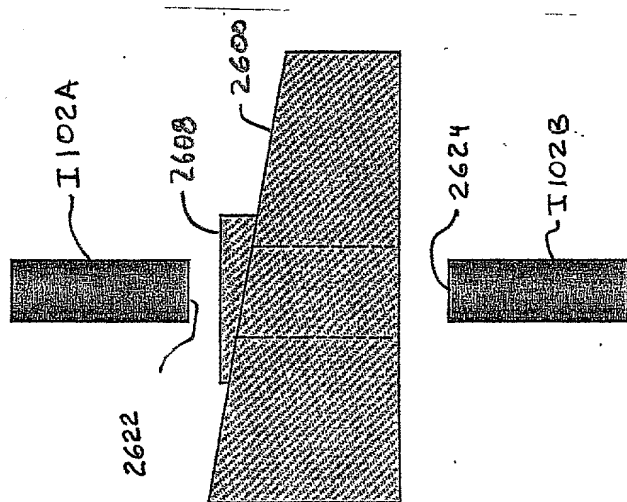
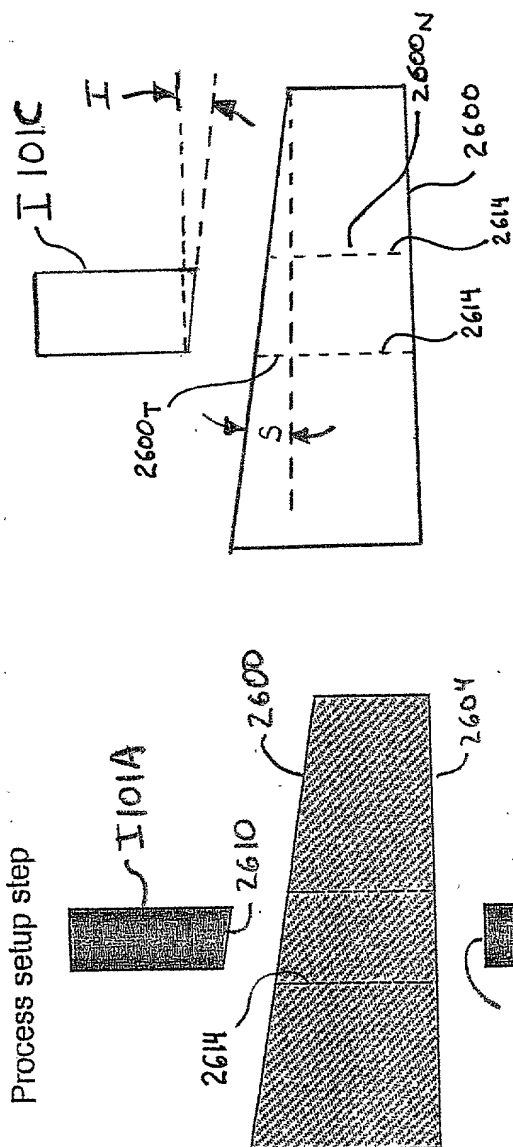


FIG. 10.3

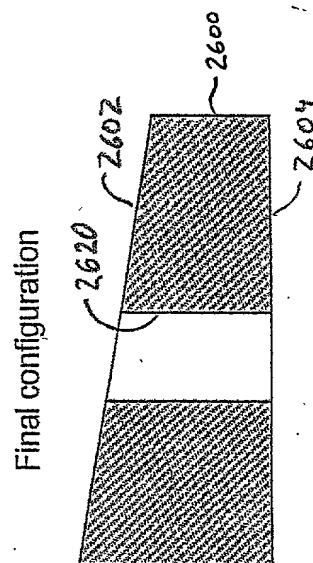


FIG. 104

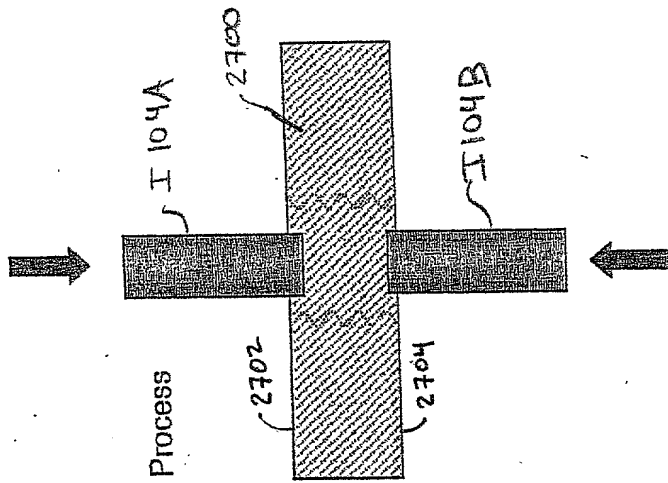


FIG. 105

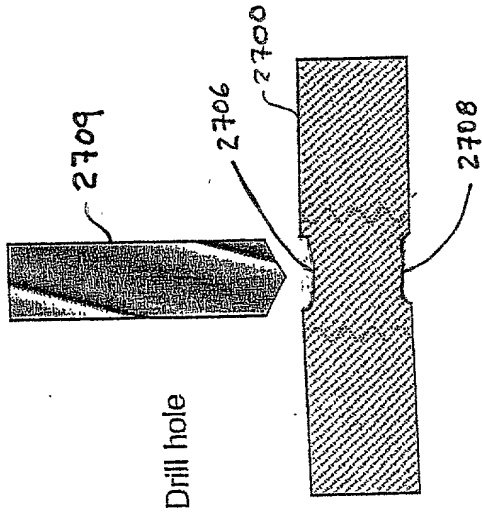
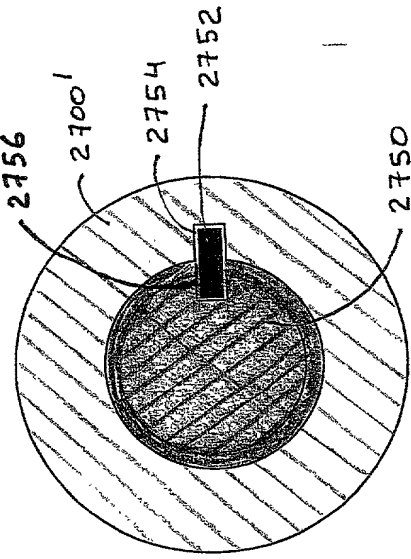


FIG. 106A



Assembled Connection

FIG. 106B

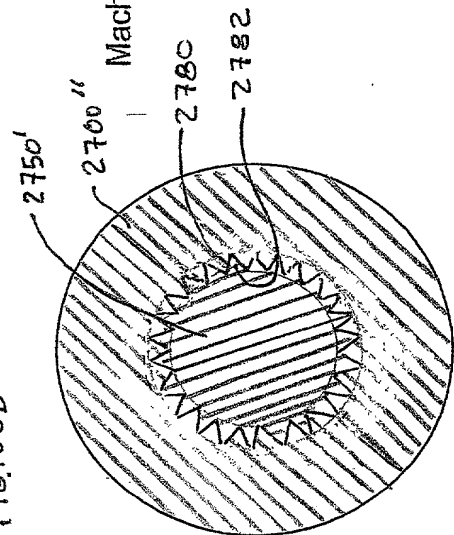


FIG. 106

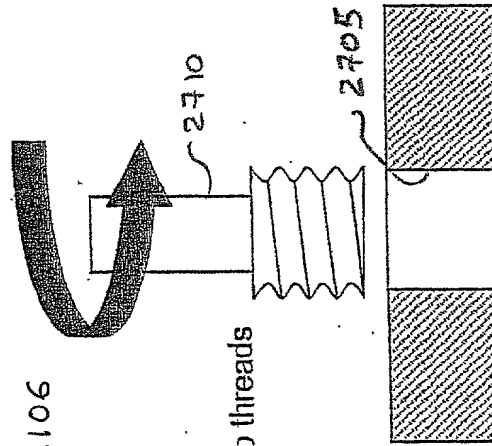
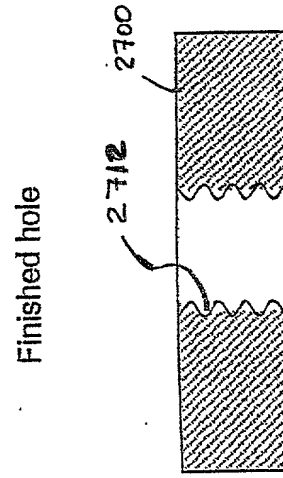
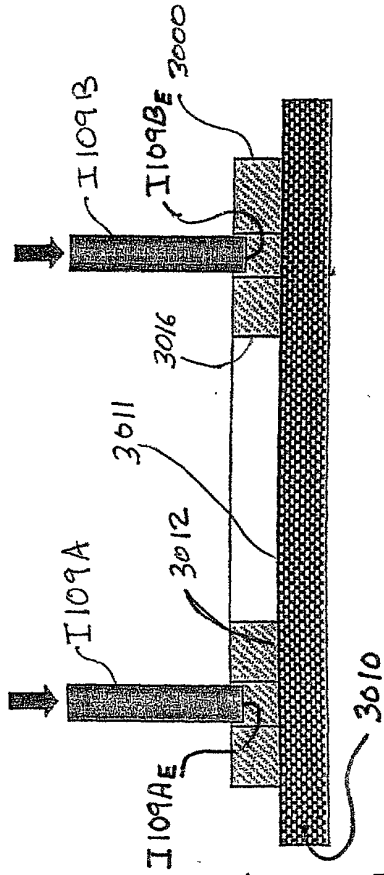
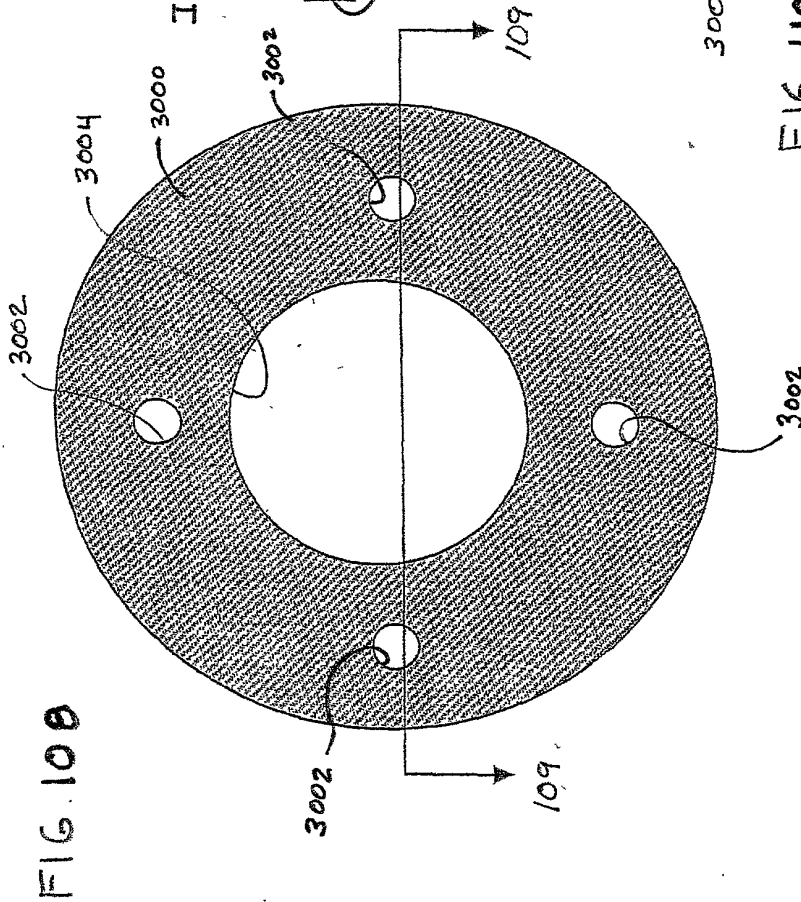


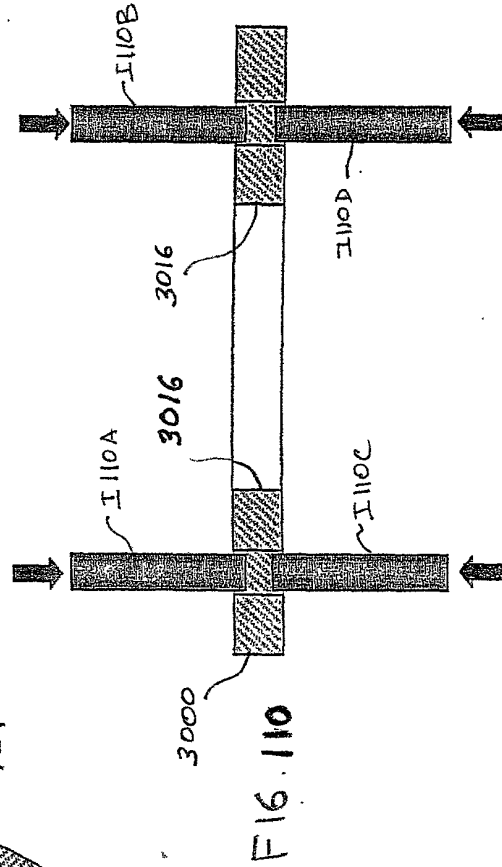
FIG. 107



2002EFO" 8049300T
 FIG. 109



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Simultaneous or sequential treatment of a pattern
 of holes, one-sided or two-sided

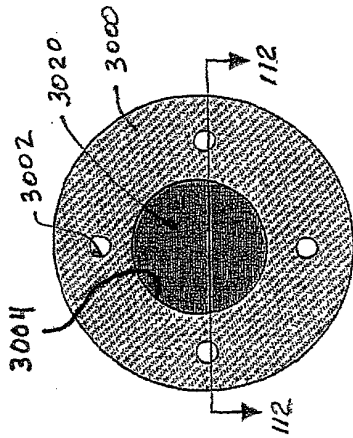


FIG. 111

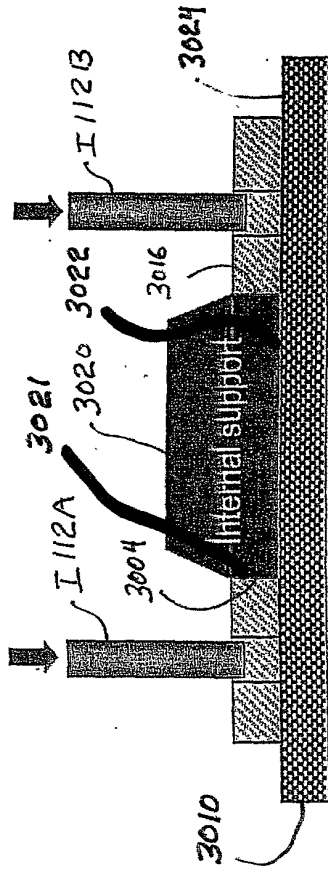


FIG. 113

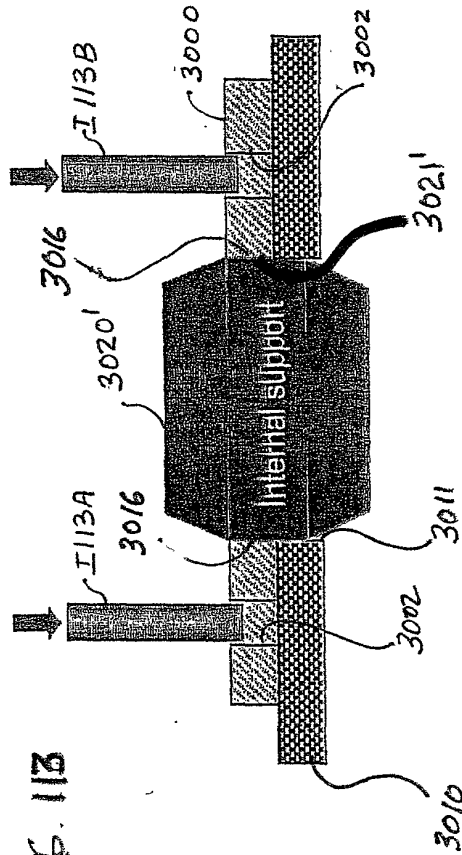
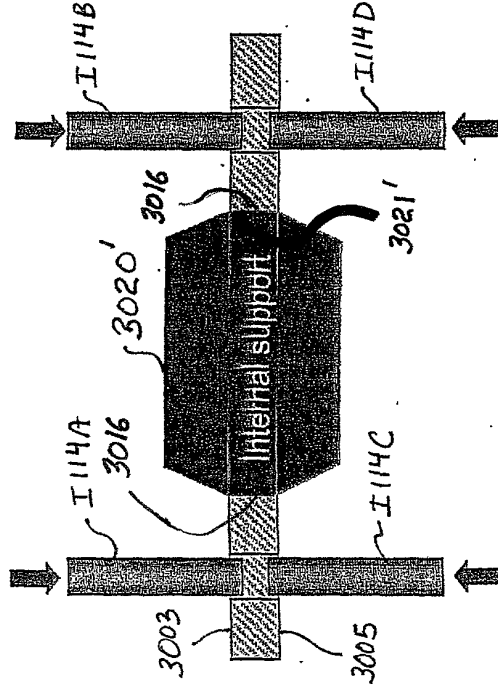


FIG. 114

Support

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Simultaneous or sequential treatment of a pattern of holes, one-sided or two-sided with internal support

FIG. 116 2006T0" 8049900T

FIG. 118

Machine large hole diameter

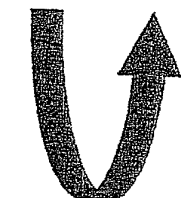


FIG. 115

Process large diameter

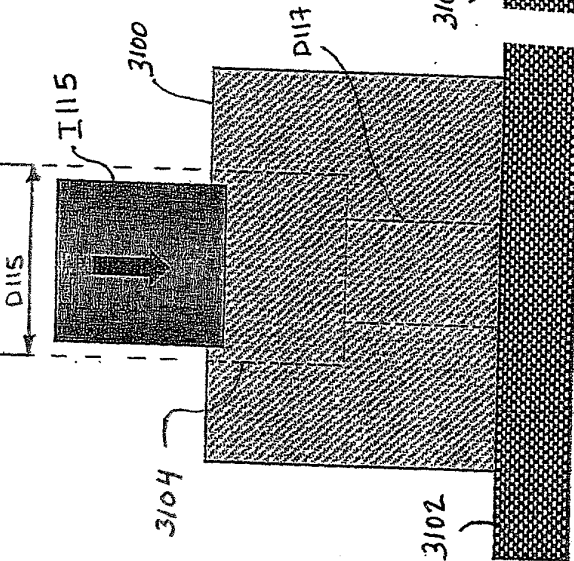
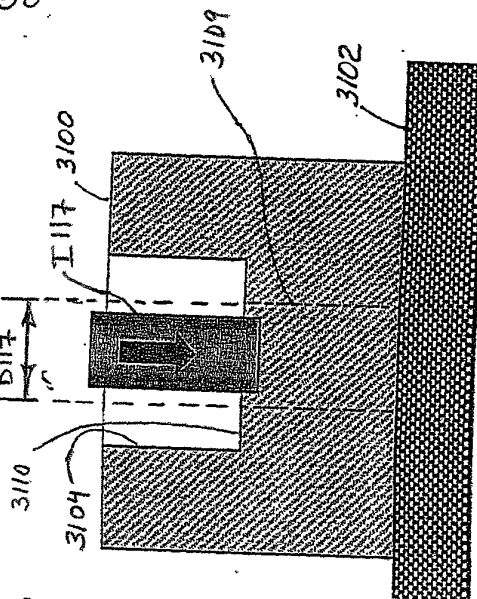
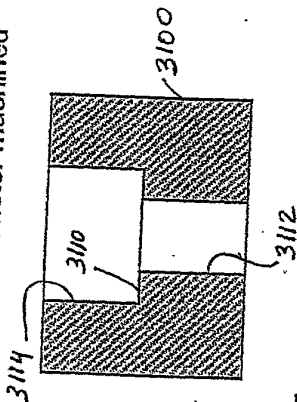


FIG. 117

Process small diameter



Finished part after
small diameter machined

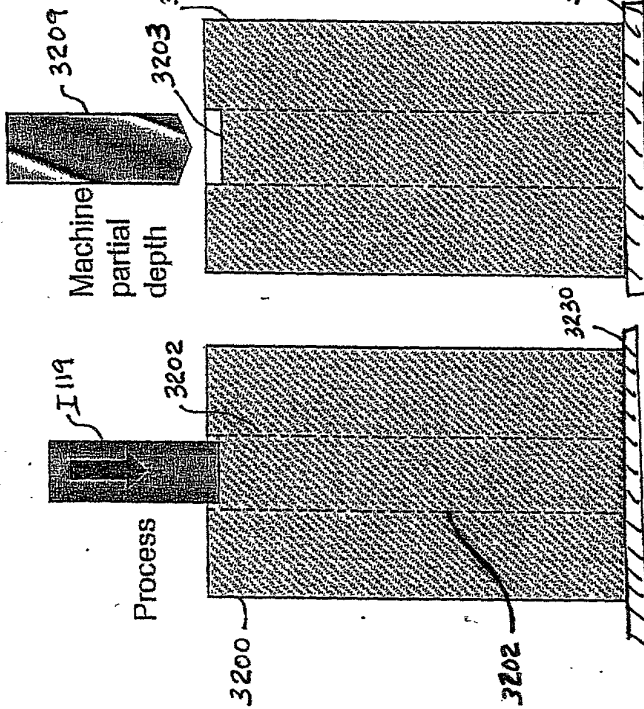


Treatment of a stepped hole

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FIG. 120



Machined configuration

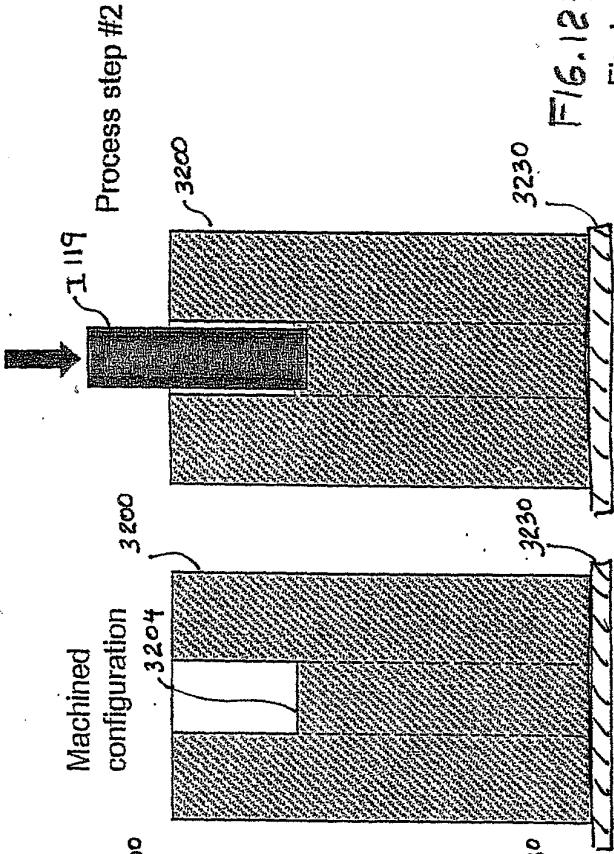


FIG. 127

Final configuration

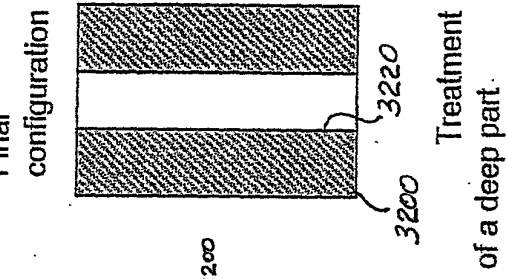


FIG. 126

Machine through depth

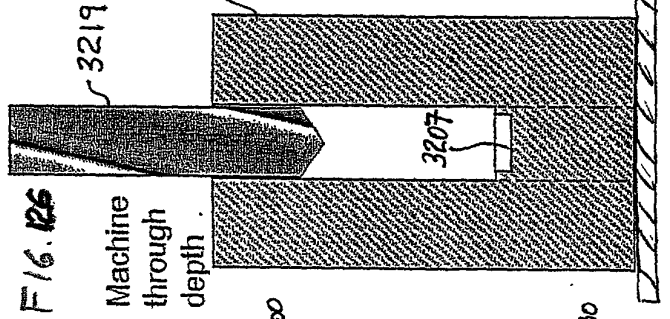


FIG. 125

Process step #3

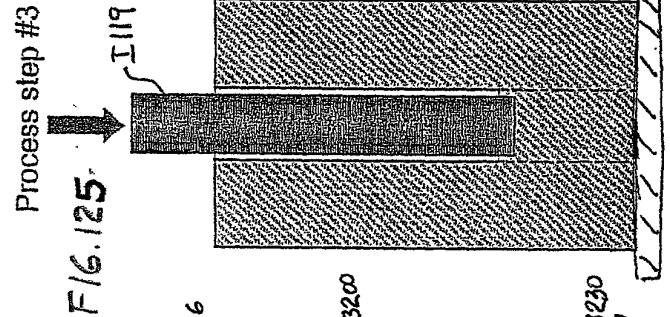


FIG. 124

Machined configuration

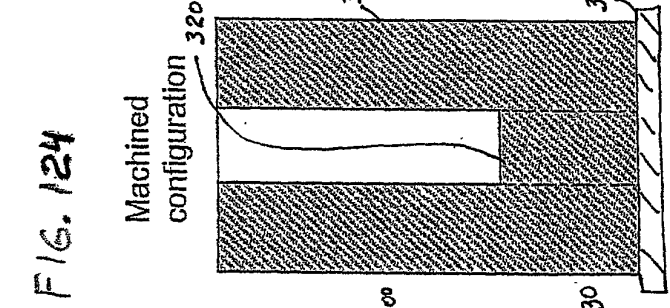


FIG. 123

Machine partial depth

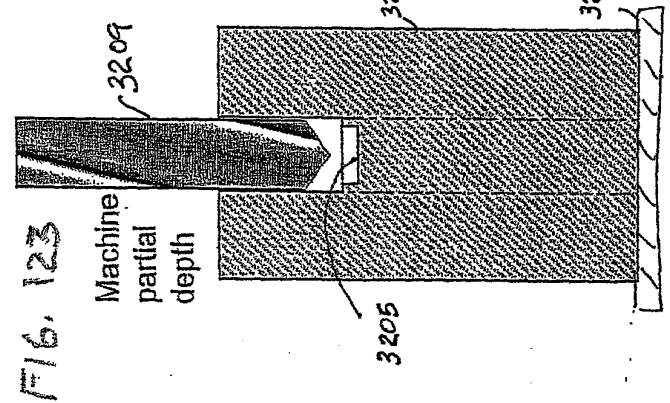


FIG. 120

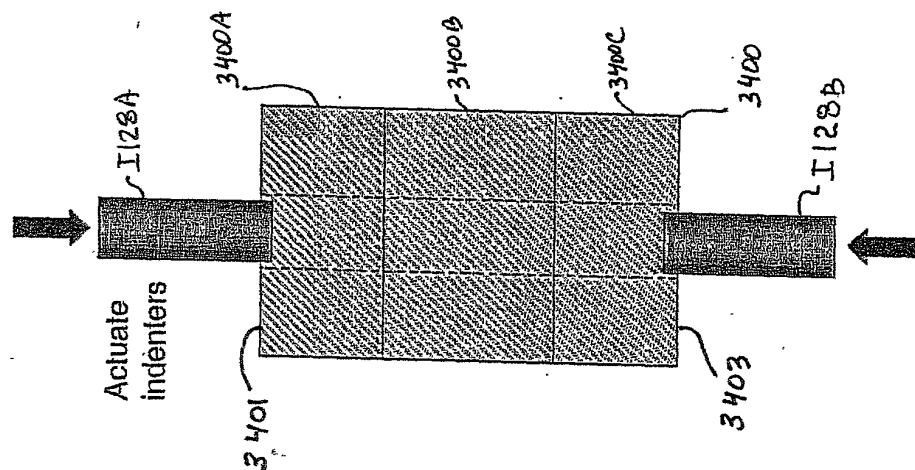
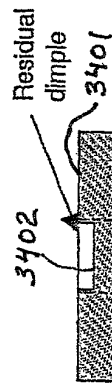


FIG. 129

Remove 1st indenter
 Unload 2nd indenter



Setup step.
 For machining
 Partial depth

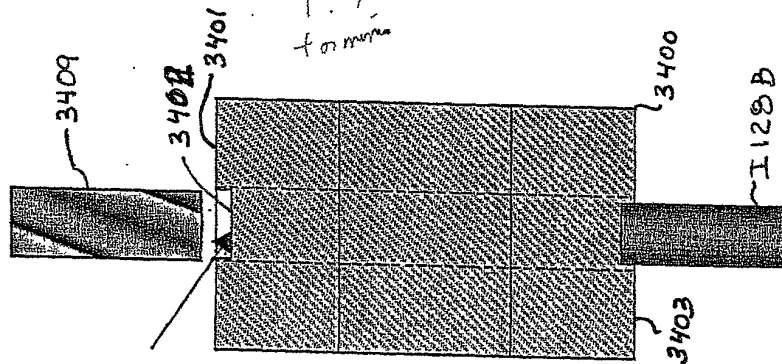
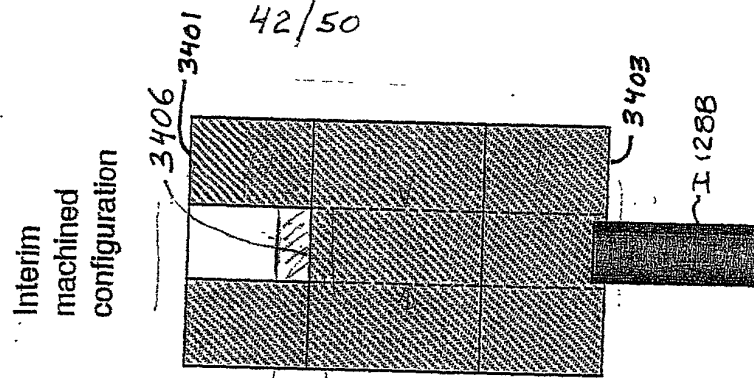


FIG. 131



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FIG. 132

Process step #2
Actuate indenters

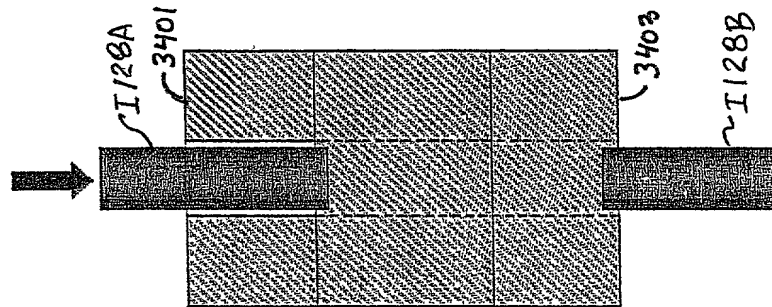


FIG. 133

Release and remove
indenters

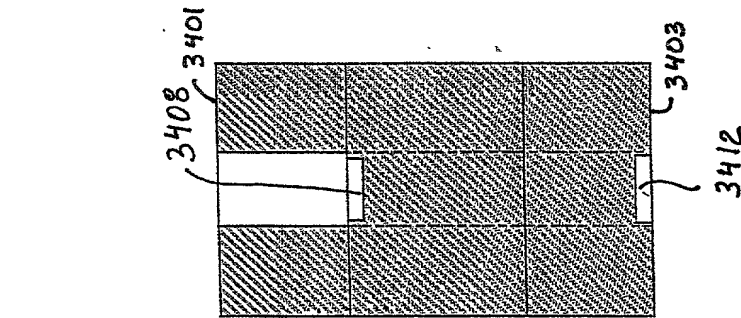


FIG. 134

Final machine
hole

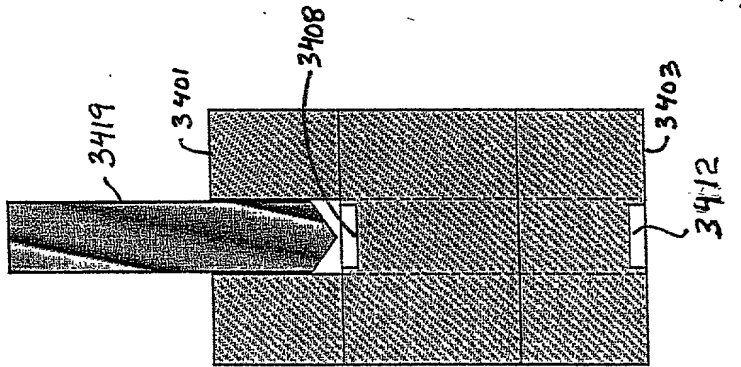
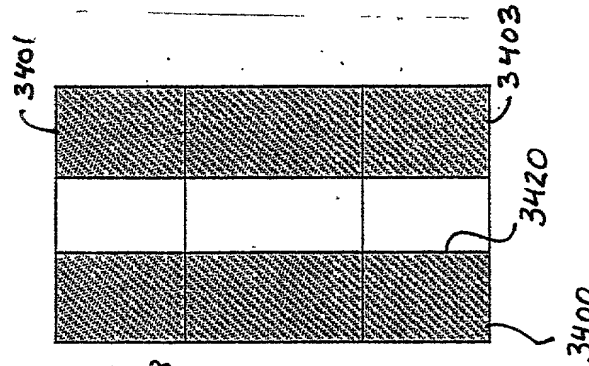


FIG. 135

Final configuration
Note: hole may have
countersink, counter-
bore, step, or other
feature.



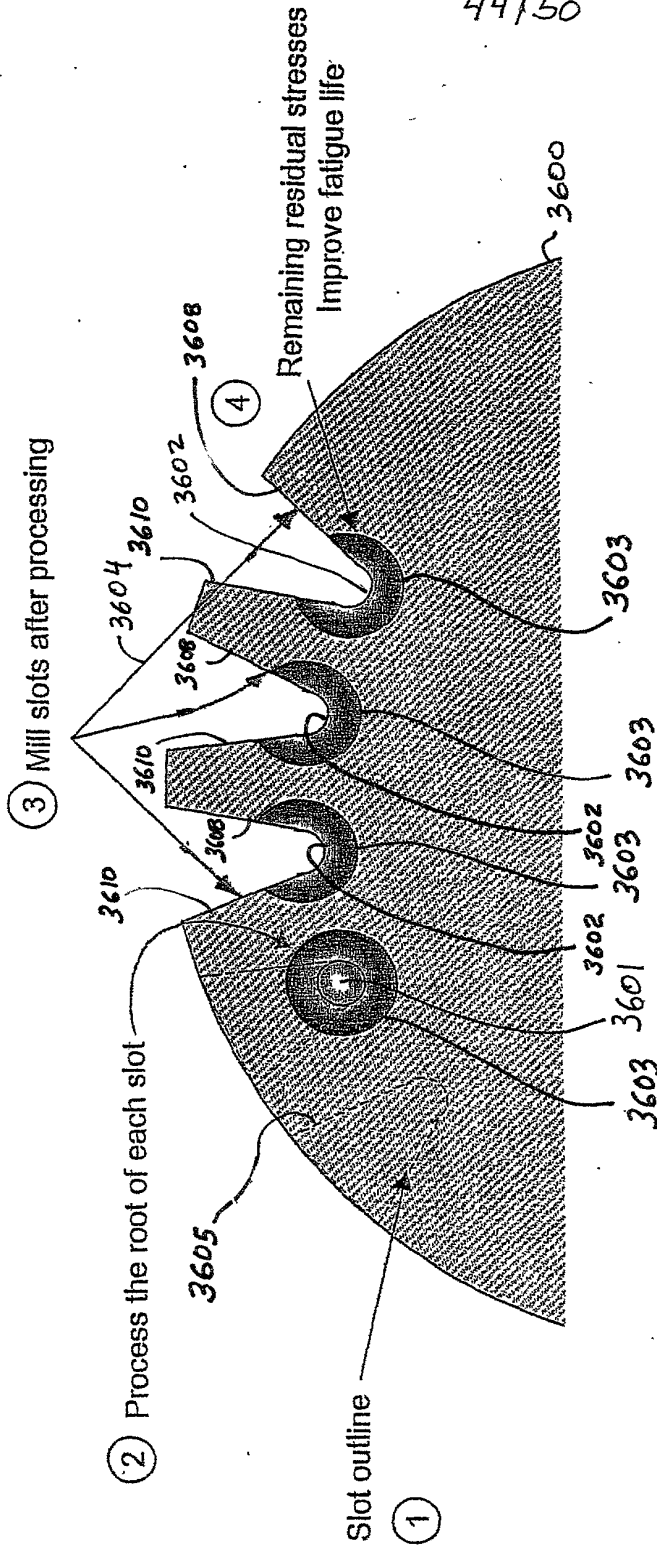


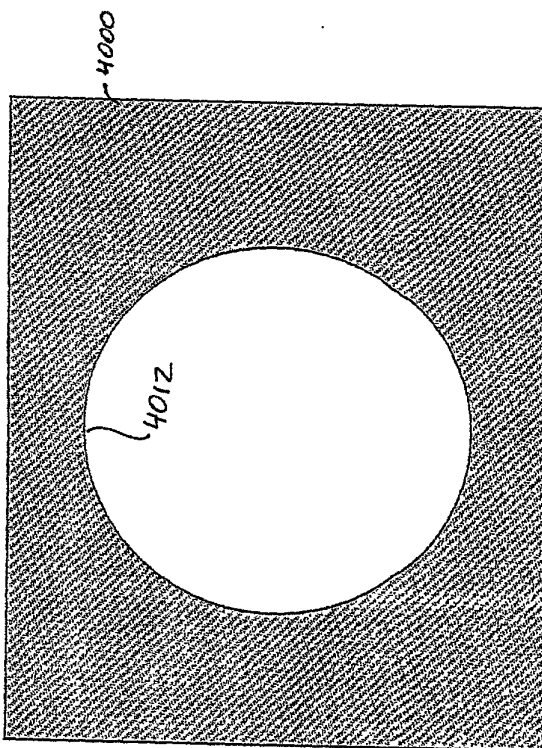
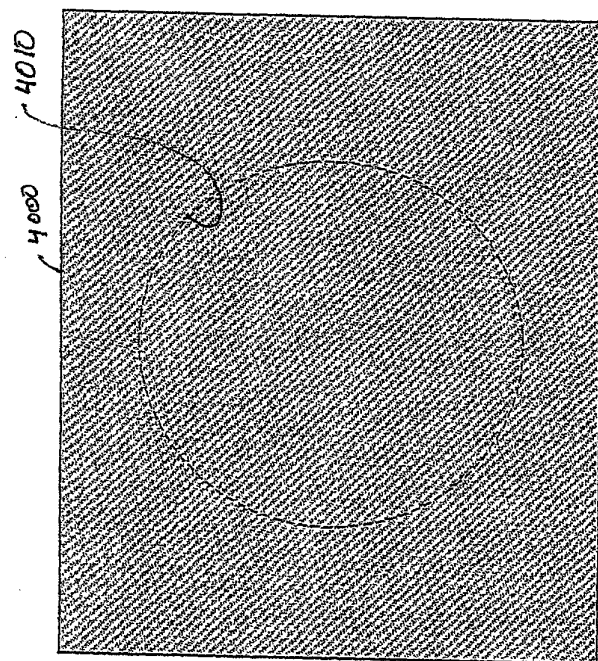
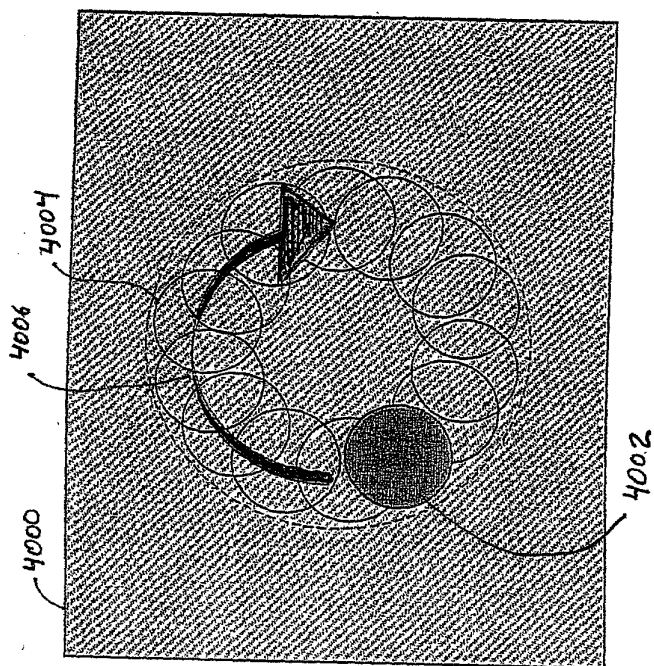
FIG. 136

Treatment of a slotted structure such as a gear or disk

200670" 8049900T

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Docket No.: SI1-2627-U-C5 Sheet 45 of 50
Applicant: EASTERBROOK, Eric T.
Serial. No.: n/a Filing Date: 01/30/02
Title: METHOD AND APPARATUS FOR IMPROVING THE
FATIGUE LIFE OF COMPONENTS AND STRUCTURES
CALL: R. Reams Goodloe, Jr.
Phone: (253)859-9128/ Reg. #32,466/ Cust#20793



Treatment of a
round aperture using an
overlapping pattern of
dimples around the perimeter

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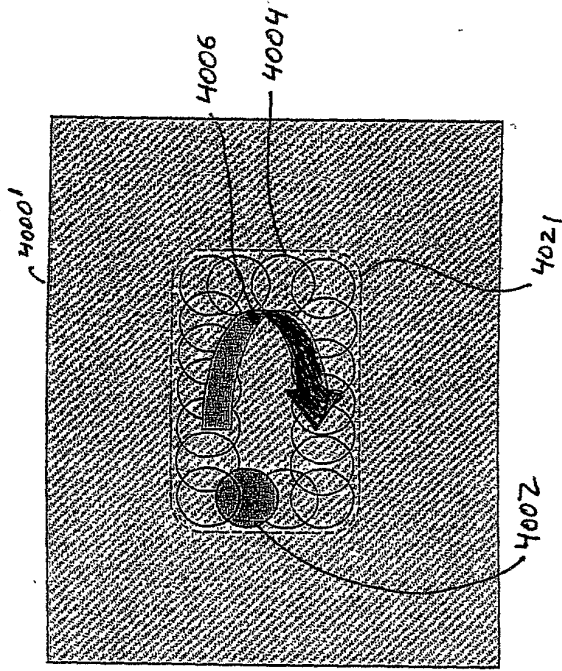


FIG. 141

Treatment of a
non-circular aperture using
an overlapping pattern of
dimples around the perimeter

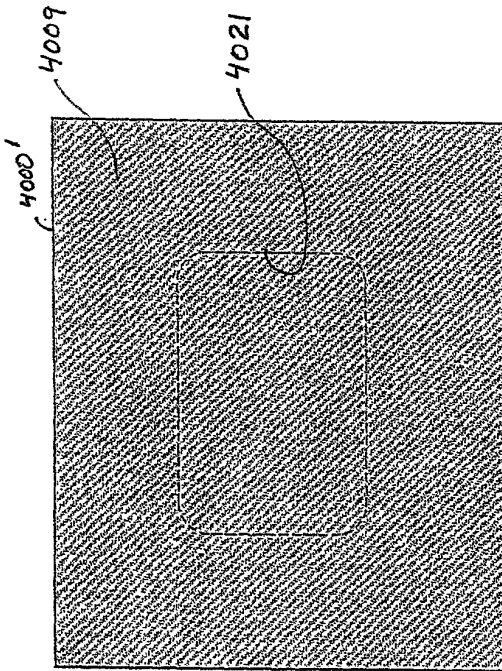


FIG. 140

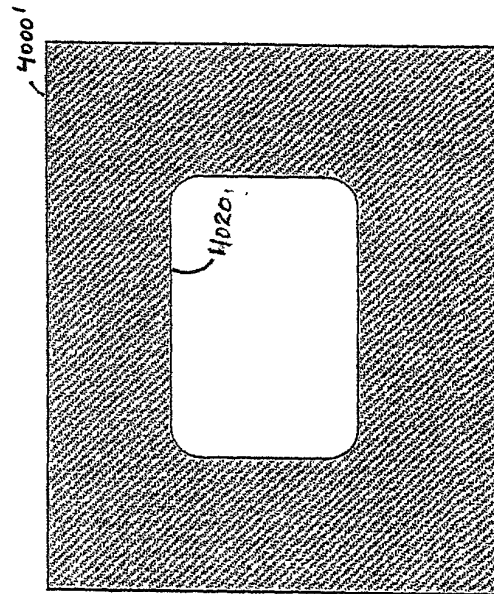
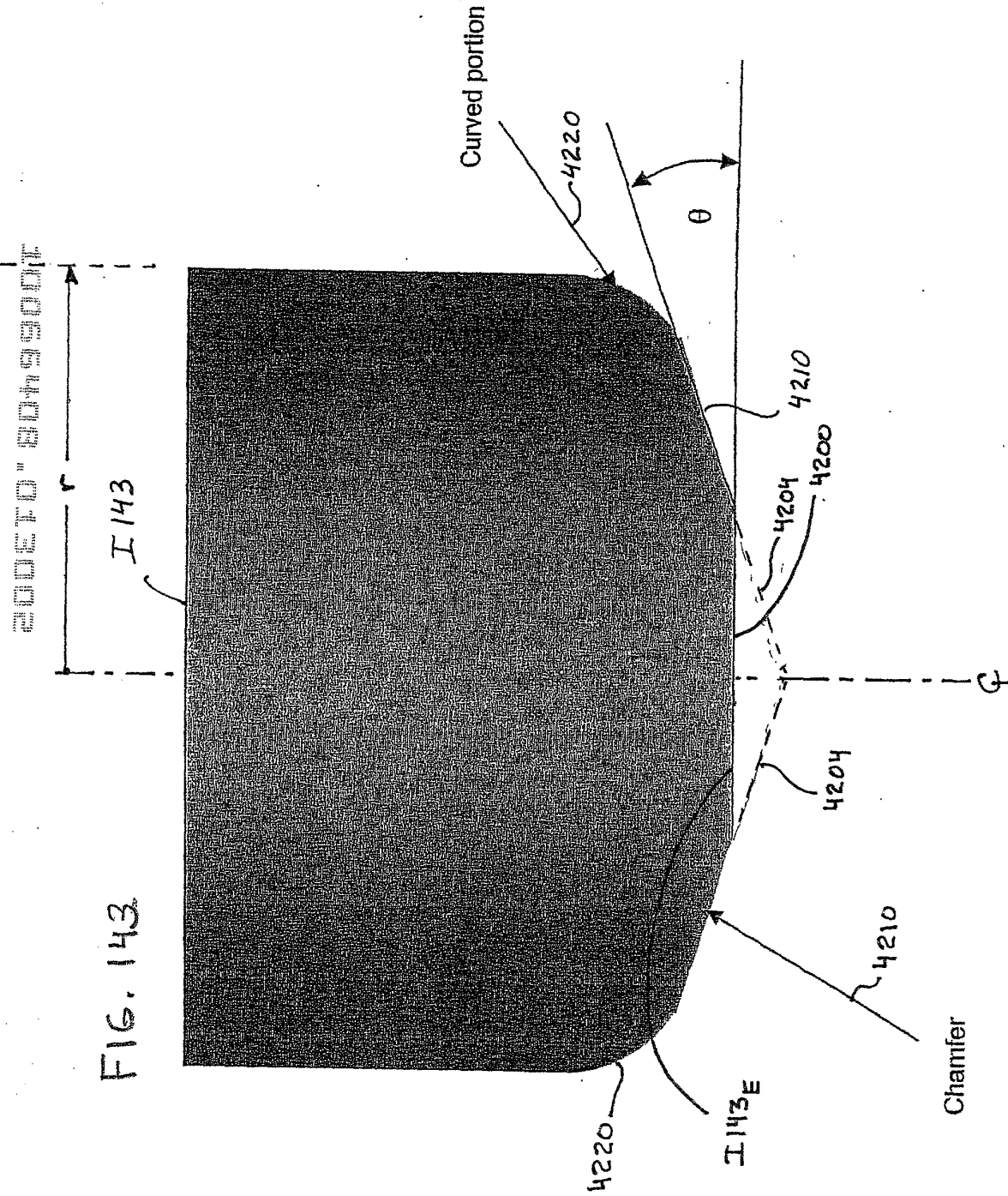
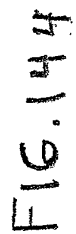


FIG. 142

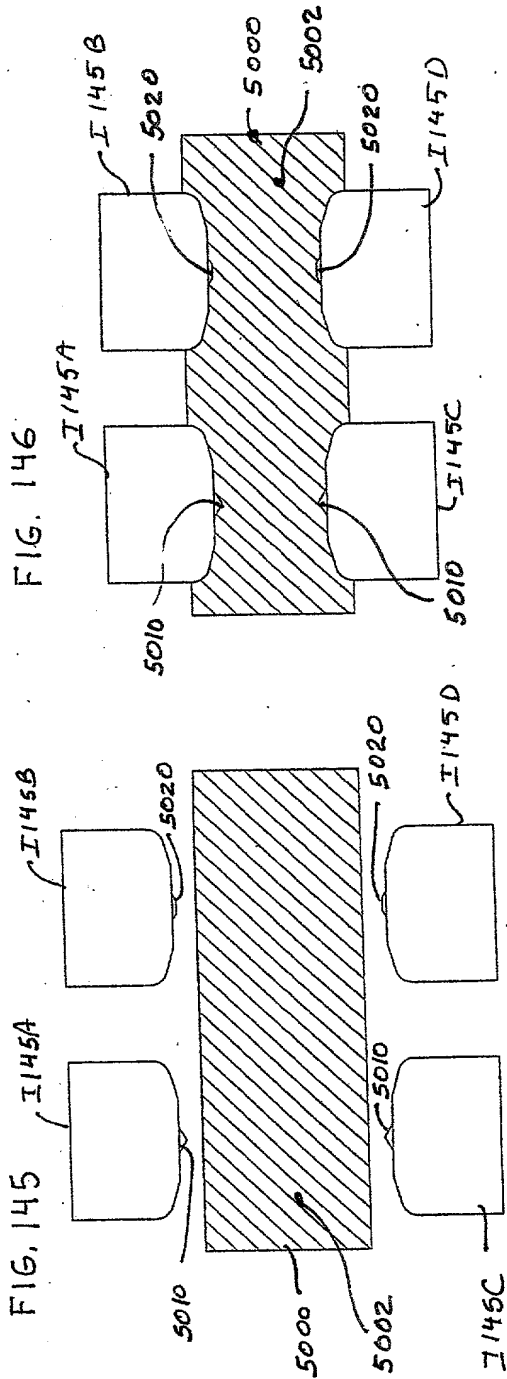
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Indenter end shape using flat, chamfered and curved portions for approximating a uniform pressure profile

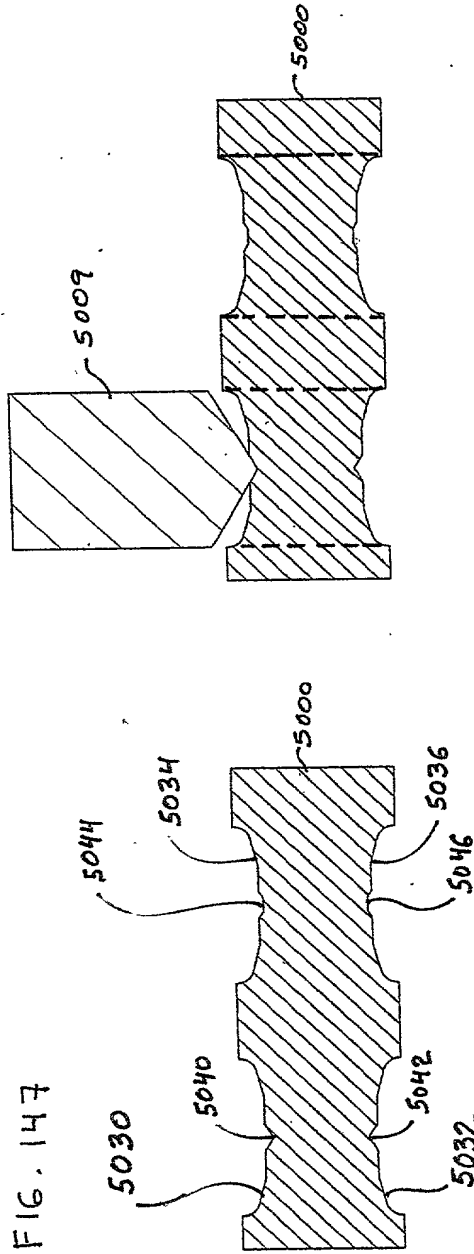


Indenter end shape for approximating a uniform pressure profile with drill center feature



Actuation of Indenters Into Part

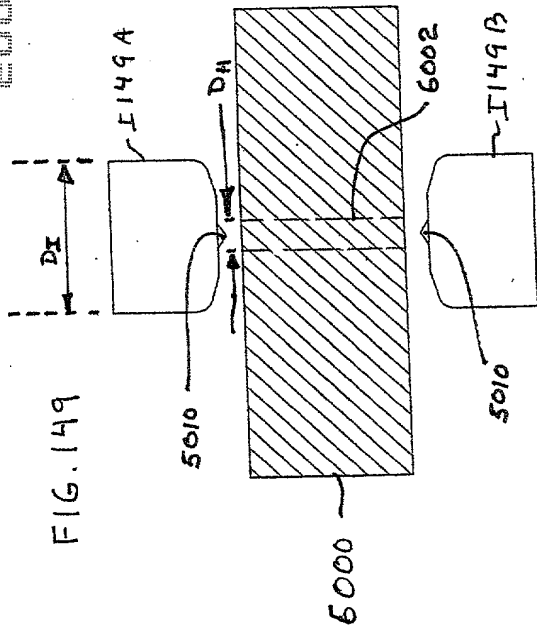
Setup Step for Two Indenter End Styles
With Drill Aligning Feature. One Conical and the
Other a Truncated Cone



Drill Out Hole, Drill Centers on Dimple

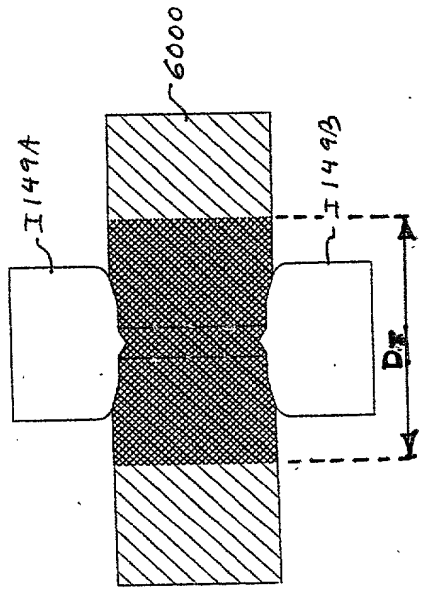
Cross Section of Dimples After
Treatment and Indenter Withdrawal

FIG. 149



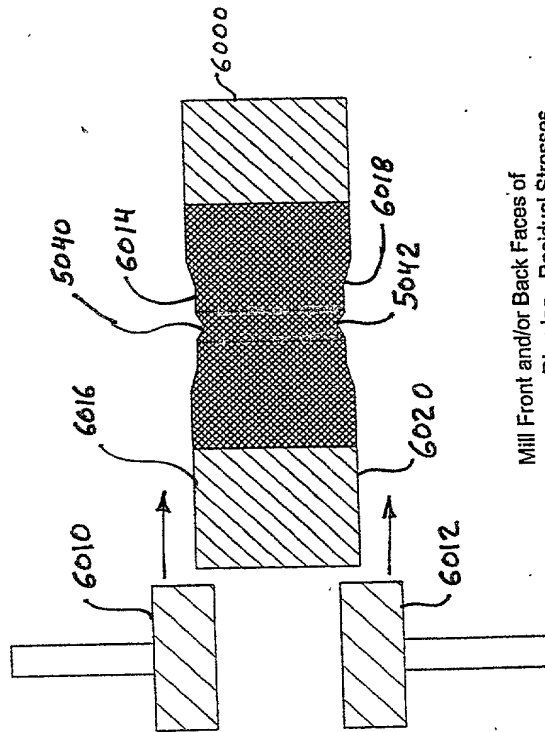
Setup Step for Treating Part With Extra Thickness Using Indenters Much Larger Than the Final Hole Diameter

FIG. 150



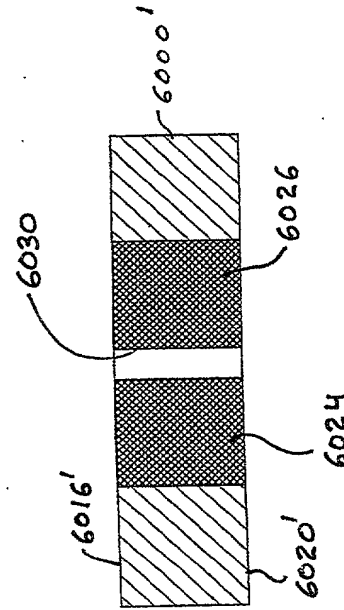
Actuation of Indenters Into Part, Extent of Residual Stress Well Beyond the Future Wall of the Small Diameter Hole

FIG. 151



Mill Front and/or Back Faces of Structure to Remove Dimples - Residual Stresses May Relax Slightly

FIG. 152



Drill Out Hole Leaving Large Zone of Compressive Residual Stress